Subsistence activities of prehistoric Polynesians : Analyses of shell artifacts and shell remains excavated at prehistoric sites on Mangaia, Cook Islands(Dissertation_全文)

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学位申請論文

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（論文内容の要旨）

クック諸島マンガイア島の先史生活遺跡から出土した遺物を、貝製品と貝殻を中心に分析し、あわせて現在の漁労活動を分析することにより、先史ポリネシア人の生業活動を推定した。

論文１では、海岸にあるワイロロガ遺跡の上層（AD１３～２０世紀）と下層（AD１１～１７世紀）から出土した遺物と遺構の種類を分析し、この遺跡が生活遺跡であり、ここでは魚釣り活動が時代とともに衰退し、陸上での活動が盛んになったことを示した。

論文２では、ワイロロガ遺跡と内陸にあるガアイツタキ遺跡（AD１１～１７世紀）から出土した貝製釣針を分析した。その結果、ほとんどの釣針がオセアニアで広く流布していた方法で製作されたことがわかった。またワイロロガ遺跡の下層の時代の人々は他島と活発に交流し、裾礁内と外洋で魚を捕っていたのに対し、同時代のガアイツタキ遺跡の人々は主に裾礁内で魚を捕り、他島とあまり交流しなかったらしいことを推定した。そして、先史時代のマンガイア島には生業パターンの異なる人々が共存していた可能性を呈示した。

論文３では、ワイロロガ遺跡の下層から出土した貝殻遺物、およびマンガイア島の現生貝を分析した。その結果、人々は裾礁全体を利用して巻貝や二枚貝を採集し、それらを食料や道具などとして用いたが、その際に大型の貝を選択的に利用し、利用効率のよいマルサザエを最もよく利用していたらしいことを推定した。人々は島で手に入る貝資源を無駄なく効率的に利用することによって、資源の限られた島嶼環境に適応していたと考えられた。

以上から、先史時代のマンガイア島では、人々の生業活動にはいくつかのパターンがあり、AD１１～１７世紀に海岸部に生活していた人々の場合、他島と活発に交流し、裾礁内と外洋で魚を捕り、貝資源を無駄なく効率的に利用することによって島嶼環境に適応する、という内容であったことが推定できる。

主論文１

The finds excavated at the Vairoronga site on Mangaia, Southern Cook Islands

（クック諸島マンガイア島ワイロロガ先史遺跡から出土した遺物の分析）

Prehistoric Mangaians: The People, Life and Language

（１９９８年１２月刊行）印刷中

The finds excavated at the Vaironga site on Mangaia, Southern Cook Islands

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Abstract A prehistoric living site, the Vaironga site, was excavated on Mangaia, Southern Cook Islands. Artificial remains made of shells, sea urchin spines, basalts, coral stones, lime stones and bones; faunal remains (fish bones, used shells, bird bones and mammal bones); and structural remains (earth ovens and post holes) unearthed from the site were compared between the Upper Layer (AD 13-20C) and the Lower Layer (AD 11-17C). The variety of the finds showed that the prehistoric Mangaians used the area as a multi-functional habitation in prehistoric times. The percentages of individual artificial items to the total artificial remains and percentages of individual faunal items to the total faunal remains indicated that fishing activities by the people around the site became less popular, and land activities became more popular in the passage of time. Such a change in subsistence activity likely associated with the progression of forest clearance and cultivation on Mangaia. The development of land activities on Mangaia likely occurred in the same period as the development of agriculture in the Marquesas Islands.

Key Words: Mangaia, coastal zone, prehistoric living site, subsistence activities

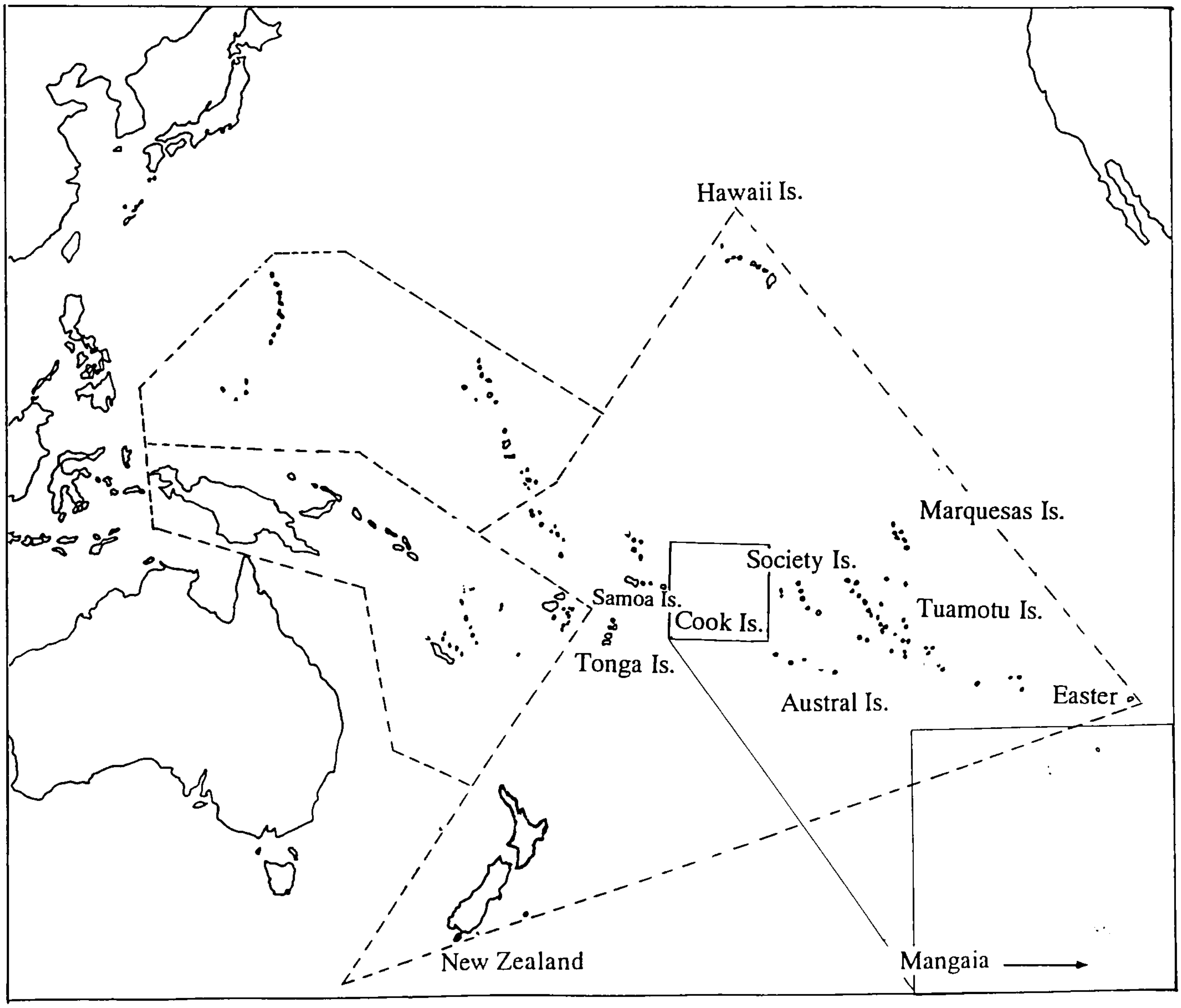
INTRODUCTION

In Polynesia, by three thousands years ago, Tonga and Samoa had been settled by the Lapita people who are regarded to be the ancestors of present-day Polynesians (Green, 1979), but the subsequent history of migration in Polynesia is still unclear. The hypothesis that the people from Samoa or Tonga directly settled the Marquesas Islands around two thousands years ago (Emory and Sinoto, 1965) is being reappraised, and the possibility that the Cook, Austral, and Society Islands were settled first has been proposed (Kirch, 1986; Katayama, 1987; Irwin, 1989). Actually, it has been shown that a site on Pukapuka in the Northern Cook Islands dates 2300 years ago (Chikamori, 1988), and sites on Maupiti and Huahine in the Society Islands date to more than one thousand years ago (Sinoto, 1983). However, no site dates back more than one thousand years in the Southern Cook and Austral Islands.

By the beginning of the 20th century, unique systems of subsistence, society and culture had developed on every island in Polynesia (Buck, 1930; 1944; 1957; Handy, 1923). However, on most islands including Mangaia in the Southern Cook Islands, research is too scanty to reconstruct their prehistory.

On Mangaia, some living sites in inland rock shelters have been excavated (Kirch et. al, 1991; Kirch et. al, 1992; Oshima et al., 1998 in press). A coastal site named Vairoronga was chosen for another excavation because most Lapita sites were located in coastal zones (Leopsky, 1988).

Figure 1. Oceania and Cook Islands.

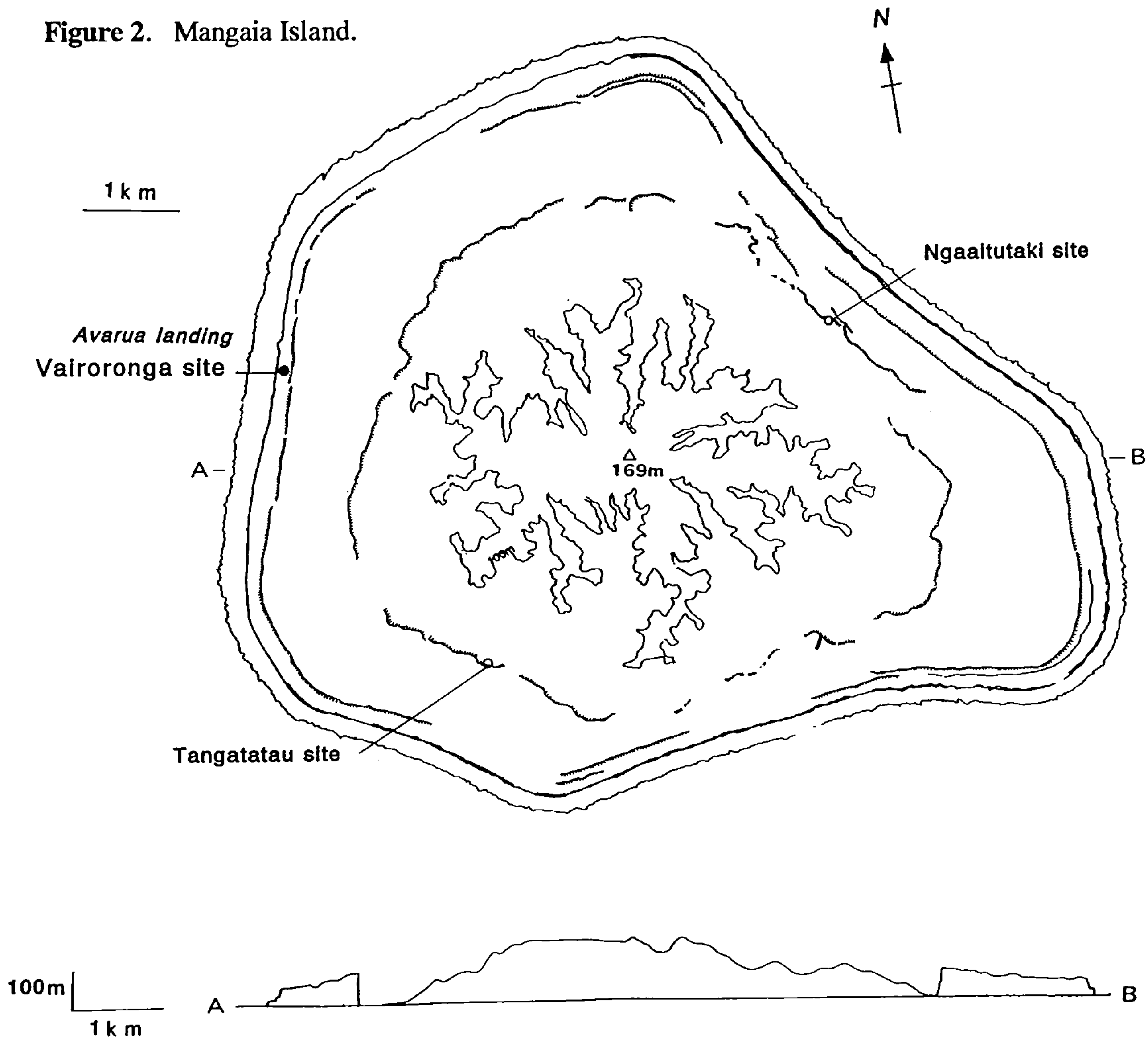


The present paper describes the finds excavated from the Vairoronga site, and discusses the subsistence activities people carried out there.

MANGAIA ISLAND

Mangaia is the most southerly island in the Cook Islands, located at 21° 55' south latitude and 157° 57' west longitude (Figure 1), 204 km southeast of the nearest island, Rarotonga. The annual rainfall on Mangaia is estimated at about 1900 mm and the monthly temperature ranges from 21° to 27° C (Clark, 1981). This island is 51.8 km^2 in area

Figure 2. Mangaia Island.



(Figure 2), and consists of two main geological formations: a central volcanic cone rising to 169 m, and a ring of elevated limestone surrounding the volcanic cone. The elevated limestone, called the makatea, is 250-2000 m wide and 70 m above sea level at its maximum height (Marshall, 1927). Taro (*Colocasia esculenta*) is cultivated in low-lying swamps beneath the inner wall of the makatea. Bread fruit (*Artocarpus altilis*), sweet potato (*Ipomosa batatas*), dry taro (*Xanthosoma sagittifolium*) and cassava (*Manihot esculensa*) are cultivated around swamps. Scrub and trees grow in other parts of the island (Clark, 1981). A fringing reef extends out from the beach line for 150-300 m and is 0.9 m at its deepest place(Marshall, 1927). The reef's development is moderate among reefs on Polynesian islands. In the reef flat, Mangaian people gather gastropoda and bivalva (Igarashi, 1998a in press). They fish on the reef flat and reef slope, and in the open sea (Igarashi, 1998b in press). One village is on the west coast and two villages are on the makatea to the south and east. The population of this island was 1214 in 1991 according to the Survey department in Rarotonga.

ARCHAEOLOGICAL INVESTIGATIONS

The Vairoronga site is located on the northwest coast of Mangaia (Figure 2). North of the site is Avarua landing where a wide canal allows canoes to pass through. Near the Avarua landing (Figure 3), a road runs 70 m inland from the shoreline, and the outer border of the makatea runs 110 m inland from the shoreline. A coconut plantation extends 150 m on the strip between the road and the outer border of the makatea. The Vairoronga site is situated in this plantation. A permanent spring named Vairoronga is by the shore 120 m south of Avarua landing. The strip and the reef are wider and the reef flat is shallower than in other parts of Mangaia.

The site survey and excavation were carried out for 60 days in 1991 and 1993. The excavation of test pits had indicated that the northern part of the site was a cemetry and the southern part of the site was inhabited; the cultural layer was thickest in Area A and Area B (Figures 3 and 4). All finds excavated from Area A and Area B covering a total area of 27.32 m^2 were analyzed.

A datum point (O) was established on the roadside 215 m south of Avarua Landing (Figure 3). A north-south baseline was laid out on the datum point parallel to the roadside, and an east-west baseline was laid out from the datum point perpendicular to the north-south baseline. The positions of excavated areas were recorded by the distances from these lines.

Figure 3. Vairoronga site and neighboring area (o: datum point).

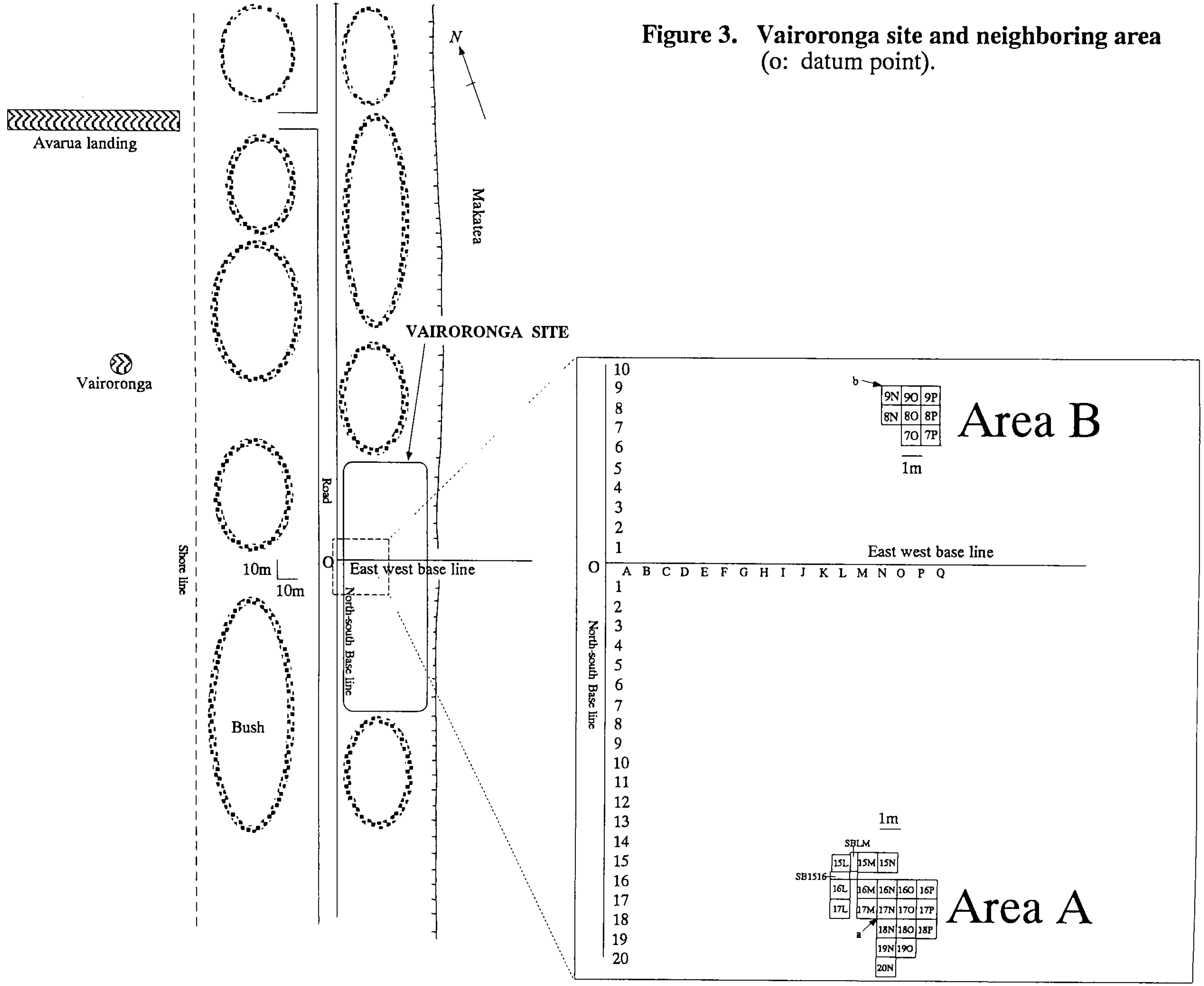
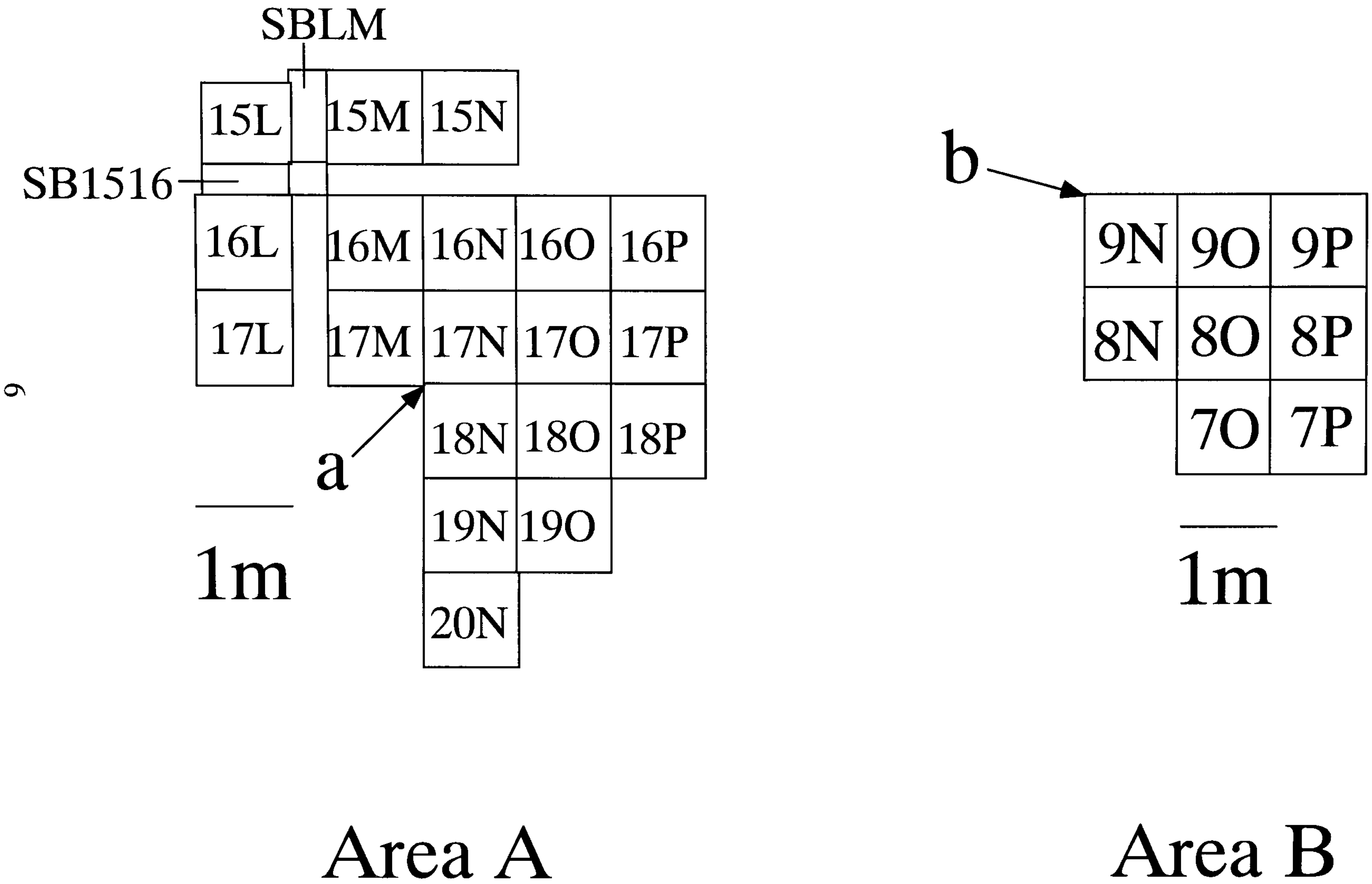


Figure 4. Excavated area of Vaironga site.



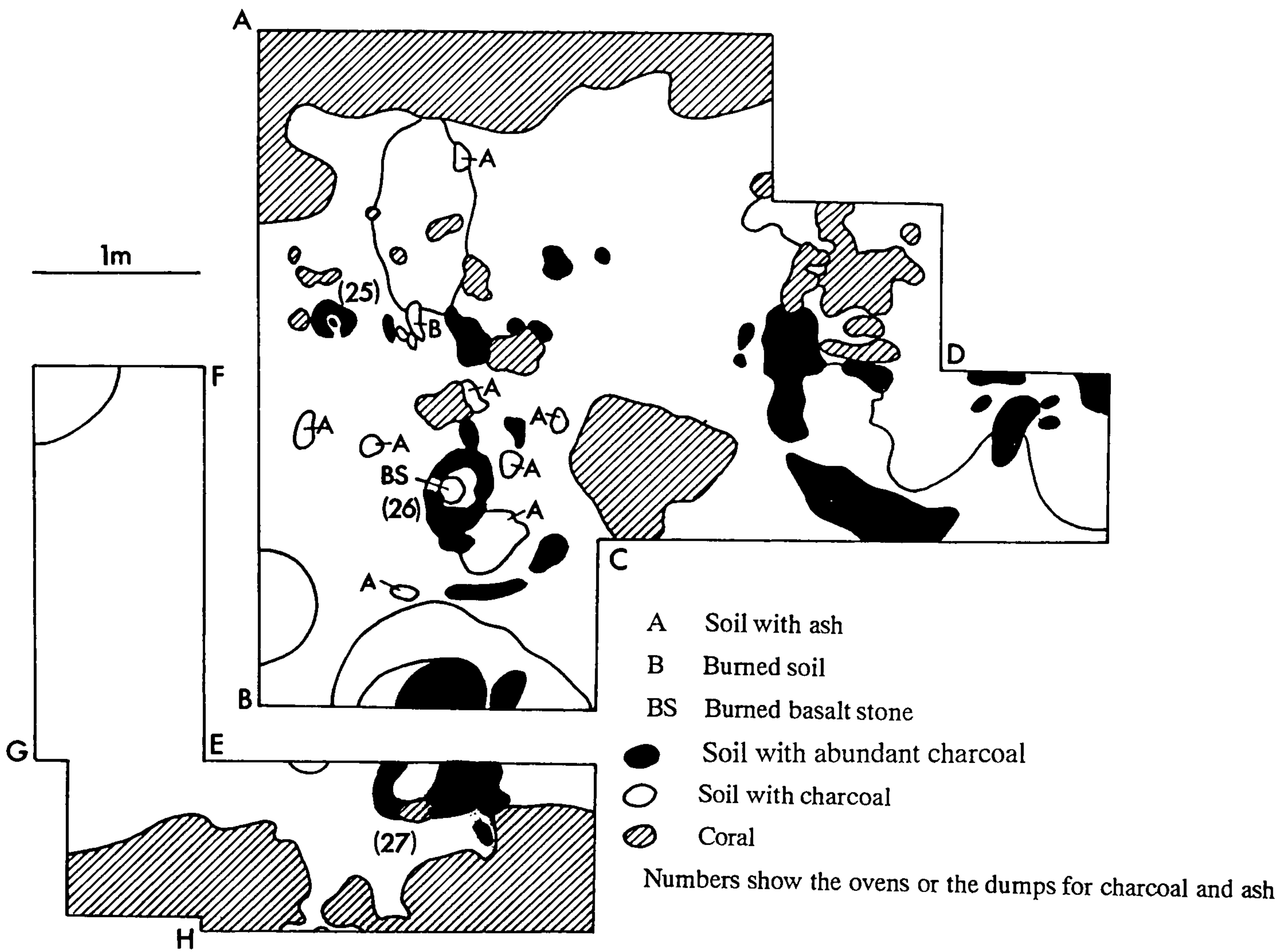


Figure 5. Plan of Area A, 50 cm under surface.

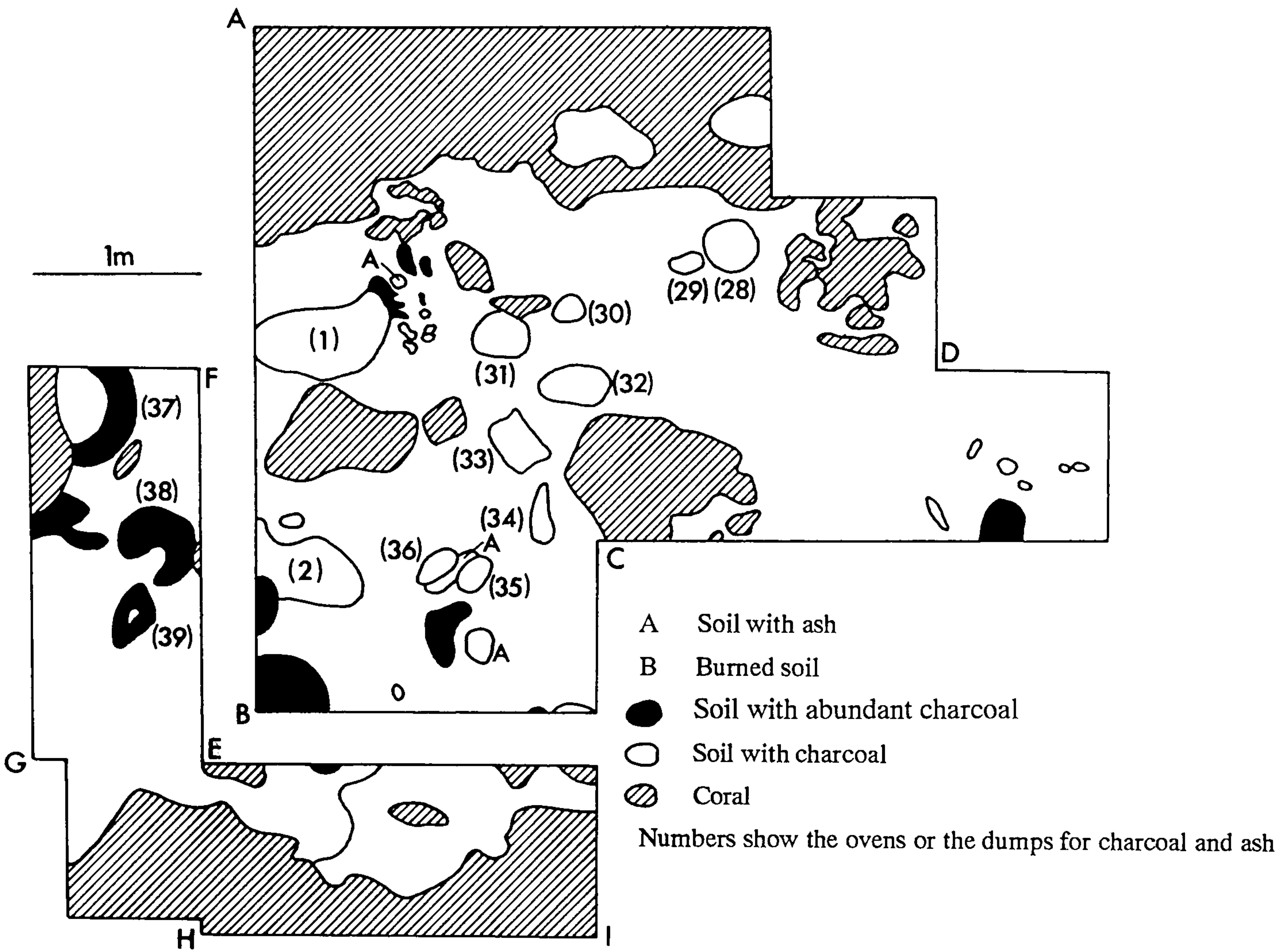
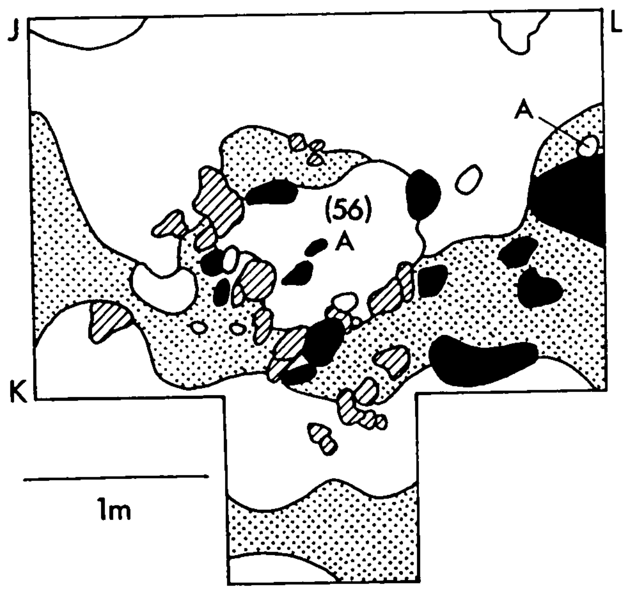


Figure 6. Plan of Area A, 70 cm under surface.



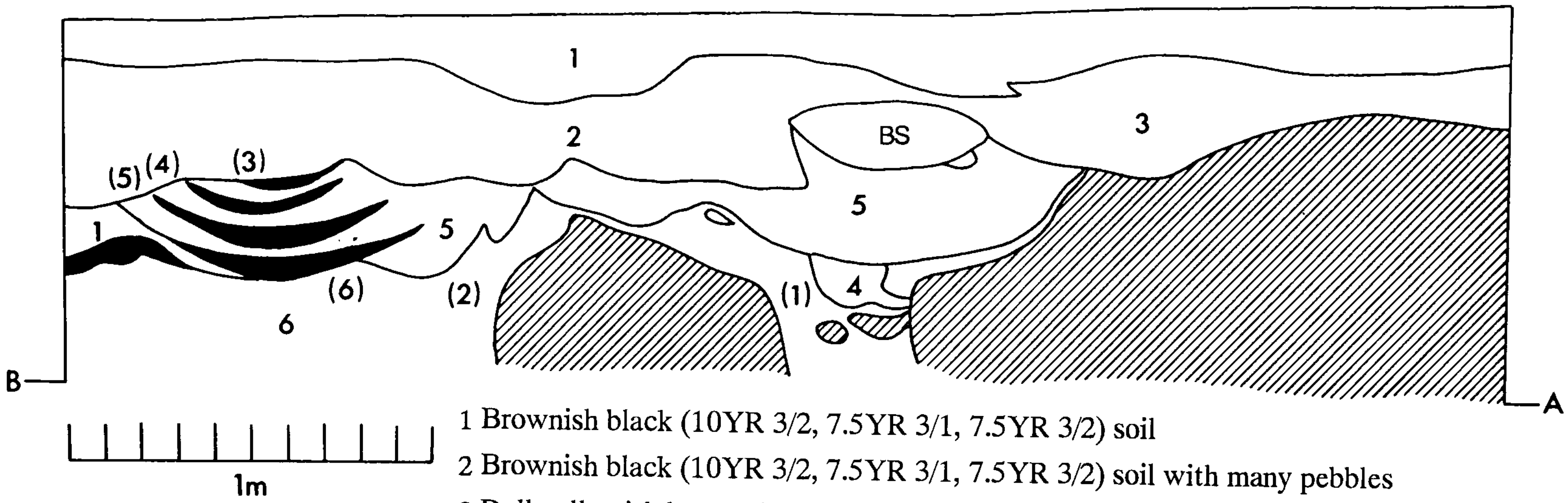
A Soil with ash

Soil with abundant charcoal

Soil with charcoal

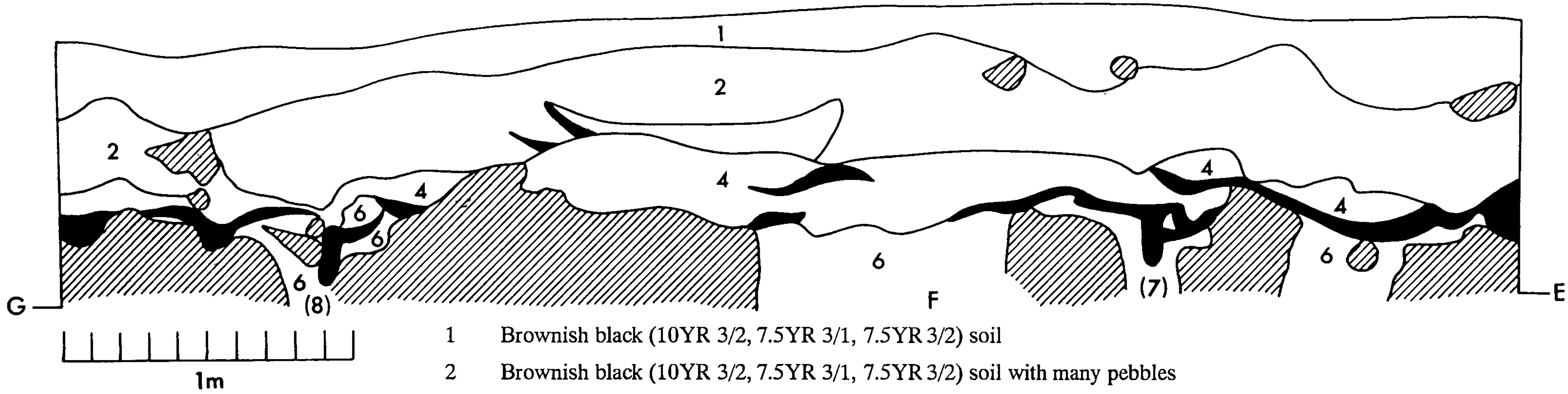
Coral

Figure 7. Plan of Area B, 30 cm under the surface. Square 9N is not shown.



1 Brownish black (10YR 3/2, 7.5YR 3/1, 7.5YR 3/2) soil
2 Brownish black (10YR 3/2, 7.5YR 3/1, 7.5YR 3/2) soil with many pebbles
3 Dull yellowish brown (10YR 4/3) soil with sand
4 Black (10YR 2/1, 7.5YR 2/1) or brownish black (10YR 2/2, 7.5YR 2/2) soil with charcoal
5 Brownish gray (10YR 4/1, 10YR 5/1, 10YR 6/1) soil with ash
6 Yellow orange (10YR 8/8, 10YR 8/6, 7.5YR 8/8) or light yellow orange (10YR 8/4, 10YR 8/3, 7.5YR 8/6)
Black (10YR 1.7/1) soil with abundant charcoal
Coral
BS Basalt
Numbers in parentheses show pits

Figure 8. Profile of north wall of squares 16M, 16N, 16O, and 16P in Area A. Figures A and B indicate points A and B in Figures 5 and 6, respectively.



1 Brownish black (10YR 3/2, 7.5YR 3/1, 7.5YR 3/2) soil

2 Brownish black (10YR 3/2, 7.5YR 3/1, 7.5YR 3/2) soil with many pebbles

3 Dull yellowish brown (10YR 4/3) soil with sand

4 Black (10YR 2/1, 7.5YR 2/1) or brownish black (10YR 2/2, 7.5YR 2/2) soil with charcoal

5 Brownish gray (10YR 4/1, 10YR 5/1, 10YR 6/1) soil wirh ash

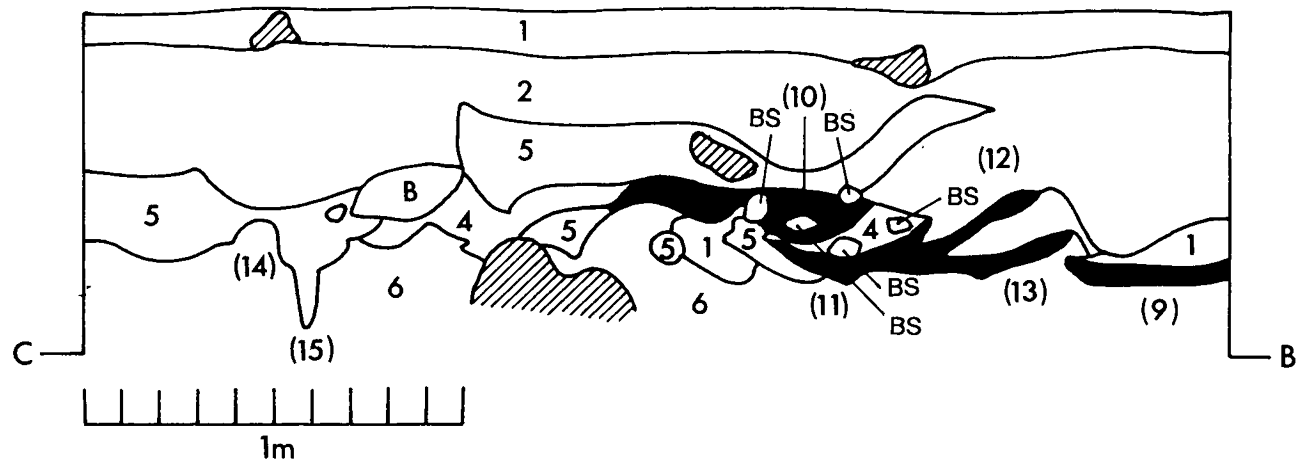
6 Yellow orange (10YR 8/8, 10YR 8/6, 7.5YR 8/8) or light yellow orange (10YR 8/4, 10YR 8/3, 7.5YR 8/6) sand

Black (10YR 1.7/1) soil with abundant charcoal

Coral

Numbers in parentheses show pits

Figure 9. Profile of north wall of squares 15M and 15N, east wall of square 15N, and south wall of squares 15N and 15M in Area A. Figures E, F and G indicate points E, F and G in Figures 5 and 6, respectively.



1 Brownish black (10YR 3/2, 7.5YR 3/1, 7.5YR 3/2) soil

2 Brownish black (10YR 3/2, 7.5YR 3/1, 7.5YR 3/2) soil with many pebbles

3 Dull yellowish brown (10YR 4/3) soil with sand

4 Black (10YR 2/1, 7.5YR 2/1) or brownish black (10YR 2/2, 7.5YR 2/2) soil with charcoal

5 Brownish gray (10YR 4/1, 10YR 5/1, 10YR 6/1) soil with ash

6 Yellow orange (10YR 8/8, 10YR 8/6, 7.5YR 8/8) or light yellow orange (10YR 8/4, 10YR 8/3, 7.5YR 8/6) sand

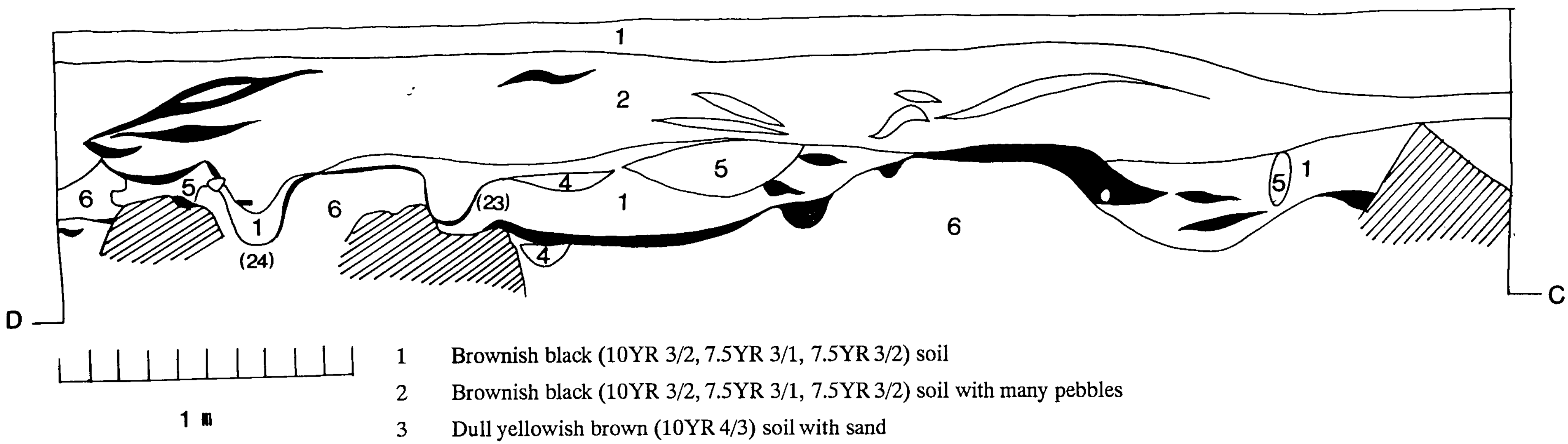
Black (10YR 1.7/1) soil with abundant charcoal

Coral

BS Basalt

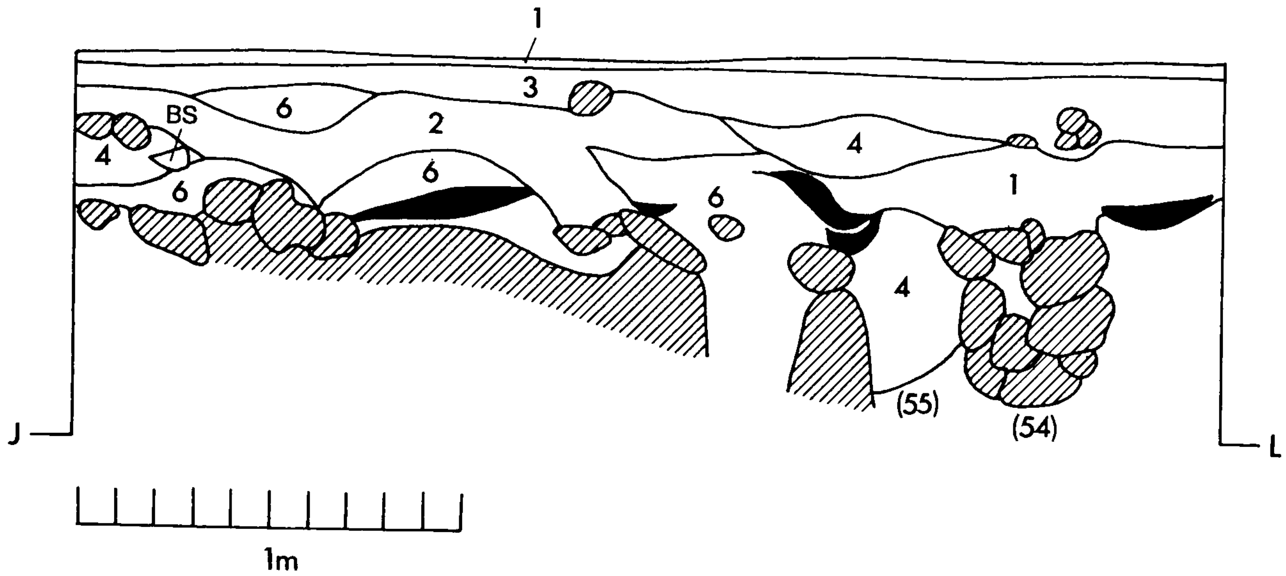
Numbers in parentheses show pits

Figure 10. Profile of west wall of squares 16M and 17M, and south wall of square 17M in Area A. Figures B and C indicate points B and C in Figures 5 and 6, respectively.



1 Brownish black (10YR 3/2, 7.5YR 3/1, 7.5YR 3/2) soil
2 Brownish black (10YR 3/2, 7.5YR 3/1, 7.5YR 3/2) soil with many pebbles
3 Dull yellowish brown (10YR 4/3) soil with sand
4 Black (10YR 2/1, 7.5YR 2/1) or brownish black (10YR 2/2, 7.5YR 2/2) soil with charcoal
5 Brownish gray (10YR 4/1, 10YR 5/1, 10YR 6/1) soil wirh ash
6 Yellow orange (10YR 8/8, 10YR 8/6, 7.5YR 8/8) or light yellow orange (10YR 8/4, 10YR 8/3, 7.5YR 8/6) sand
Black (10YR 1.7/1) soil with abundant charcoal
Coral
Numbers in parentheses show pits

Figure 11. Profile of west wall of squares 18N, 19N, and 20N, and east wall and south wall of square 20N in Area A. Figures C and D indicate points C and D in Figures 5 and 6, respectively.



1 Brownish black (10YR 3/2, 7.5YR 3/1, 7.5YR 3/2) soil
2 Brownish black (10YR 3/2, 7.5YR 3/1, 7.5YR 3/2) soil with many pebbles
3 Dull yellowish brown (10YR 4/3) soil with sand
4 Black (10YR 2/1, 7.5YR 2/1) or brownish black (10YR 2/2, 7.5YR 2/2) soil with charcoal
5 Brownish gray (10YR 4/1, 10YR 5/1, 10YR 6/1) soil wirh ash
6 Yellow orange (10YR 8/8, 10YR 8/6, 7.5YR 8/8) or light yellow orange (10YR8/4, 10YR 8/3, 7.5YR 8/6) sand
Black (10YR 1.7/1) soil with abundant charcoal
Coral
BS Basalt
Numbers in parentheses show pits

Figure 12. Profile of east wall of squares 7P, 8P, and 9P in Area B. Figures J and L indicate points J and L in Figure 7, respectively.

The datum point was 76 m horizontal to and 6.3 m above the shore line. Point "a" in Area A was 14.5 m horizontal to and 1.8 m above the baseline (Figures 3 and 4). Point "b" in Area B was 13.9 m horizontal to and 1.8 m above the baseline.

The excavation was carried out in squares as designated in Figure 4. The excavation in every square was proceeded in arbitrary 10 cm levels except when natural stratigraphic interfaces were encountered. Surface plans were drawn at every 10 cm level. Figures 5-7 show the plans of Area A and Area B. Figures 8-12 illustrate the stratigraphic profiles of Area A and Area B. Four stratigraphic layers, I, II, III, IV, were identified in both areas. Layer I consisted of brownish black soil (10YR3/2, 7.5YR3/1, 7.5YR3/2, according to the Revised Standard Soil Color Chart of the Revised Mansell system) with coral pebbles, sand, and broken shells. This layer, which varied from 5 to 30cm, contained artificial and faunal remains with no recognized structural remains. Layer II consisted of brownish black soil (10YR3/2) with many coral pebbles and dull yellowish brown soil (10YR4/3) with sand, and different soils were recognized in some spots. This layer, which varied from 5 to 55 cm, contained artificial and faunal remains with no recognized structural remains. Layer III consisted of black soil (10YR1.7/1) with a lot of charcoal, black soil (10YR2/1, 7.5YR2/1) with some charcoal, and brownish black soil (10YR2/2, 7.5YR2/2) with some charcoal. Different soils were recognized in some spots. This layer, which varied from 10 to 66 cm, contained artificial, faunal, and structural remains. Layer IV consisted of sand and coral bedrock with no cultural deposits. The sand was yellow orange (10YR8/8, 10YR8/6, 7.5YR8/8) or light yellow orange (10YR8/4, 10YR8/3, 7.5YR8/6). The depth of all combined cultural layers varied from 30 to 90 cm.

Cultural layers were classified into two layers according to their structural remain: Layers I and II with no structural remains were combined and designated the Upper Layer, and Layer III with structural remains the Lower Layer. Figures 5-7 show the Lower Layer.

Charcoal was directly collected from the walls of the excavated area for dating cultural deposits, and were analyzed at the Dating and Materials Research Center at Nagoya University. Twelve radiocarbon dates of nine charcoal samples have been obtained from the Lower Layer (Nakamura and Oda, personal communication, Appendix). All calibrated calendar dates except one are between AD 11 and 17C. Even though one is dated between AD 7 and 10C, two other dates from the same sample are between AD 11 and 17C. Thus the oldest date is discounted. Three radiocarbon dates of three charcoal samples were obtained from the Upper Layer (Nakamura and Oda, personal communication, Appendix). All calibrated calendar dates are between AD 13 and 20C. These dates show that the cultural deposits of the Vairoronga site may not have been older than those of other residential sites further inland on Mangaia; this includes the Ngaaitutaki site where the cultural deposits range from AD 11 to 17C (Oshima et al., 1998 in press; Nakamura and Oda, personal communication), and the Tangatatau site where the range is from AD 11 to 17C (Kirch et.al, 1991; Kirch et.al, 1992) (Figure2).

All of the excavated deposits were sieved through 1/8 inch (3.2 mm) and 1/16 inch (1.6 mm) mesh screening. Artifacts brought to our laboratory included artificial remains: shell artifacts, sea urchin spine artifacts, basalt artifacts, coral stone artifacts, lime stone artifacts, bone artifacts, shell flakes, stone flakes; and faunal remains: shells, fish bones, mammal bones and bird bones. The artificial remains were counted and for every layer the proportions of each type to total artificial remains were calculated. The faunal remains were weighed and in the same way the density proportions in each layer were calculated.

RESULTS

In the Lower Layer, at least 56 structural features were recognized. They are labelled by numbers in parentheses in the figures. The function of the features was inferred from their shapes. Shallow bowl-shaped pits with much charcoal inside (Nos. 3, 4, 5 and 6 in Figure 8, Nos. 10, 11, 12 and 13 in Figure 10, Nos. 25, 26 and 27 in Figure 5, Nos. 37, 38 and 39 in Figure 6) were judged to be earth ovens (umu ovens) due to their resemblance to present-day umu ovens. No. 4 contained one pair of the bivalve *Asaphys dichotoma* , and Nos. 10, 11 and 26 contained basalt umu stones, which confirmed that these pits were used as umu ovens. Deep bowl-shaped pits were not judged to be umu ovens because their shape differs from present-day umu ovens. These ovens are classified into two types: one type denotes pits filled with charcoal or ashes (Nos. 1 and 2 in Figure 8, No. 14 in Figure 10, No. 55 in Figure 12), and the other type denotes pits without charcoal or ashes (Nos. 23 and 24 in Figure 11). The former were likely dumps for charcoal and ashes considering the large amount of charcoal or ashes inside. The contours of Nos. 1 and 2 on the plan (Figure 6) were not round like present-day umu ovens, which confirms that they were not used as umu ovens. The latter were judged to be storage pits due to their pit-like shape and the lack of charcoal and ashes inside. A dish-shaped depression with much charcoal inside (No. 9 in Figure 10) was judged to be a dump for charcoal due to the large amount of charcoal inside. Pits with charcoal (Nos. 28, 29, 30, 31, 32, 33, 34, 35 and 36 in Figure 6) were judged to be umu ovens or charcoal dumps due to the abundant charcoal inside. Post-shaped holes (Nos. 7 and 8 in Figure 9 and 15 in Figure 10) were tought to be post holes due to their shapes. A deep pit filled with coral stones (No. 54 in Figure 12) was considered a dump for stones considering its shape and many stones inside. A large pit lined with coral stones around the perimeter (No. 56 in Figure 7) was judged to be a umu oven due to an analysis of the soil. The fine brownish gray soil (10YR6/1) with ashes inside the pit was more thickly deposited than in other ovens, 10 30 cm, and charcoal was scattered in patches. The soil with ashes outside the pit was not recognized but we did note brownish black soil (7.5YR3/2) with coral pebbles and sand, black soil (7.5YR2/1) with much charcoal, and brownish black soil (10YR2/2) with some charcoal.

The only structural feature recognized in the Upper Layer was a cluster of 15 coral stones, 10-100 cm in diameter, scattered in a 6 m^2 area of Area A. None of the stones were artifacts.

The artificial remains excavated from the Vaironga site are listed in Table 1, and some of them are drawn in Figure 13. The items in Area A from the Lower Layer include: shell fishhooks, sea urchin spine files, sea urchin spine plaques, basalt adzes, a basalt drill, and a basalt scraper, a bone tattooing needle, pearl-shell flakes, and basalt flakes; those from the Upper Layer include: shell fishhooks, a *Terebla* shell chisel, shell ornaments, sea urchin spine files, sea urchin spine plaques, basalt adzes, basalt drills, basalt scrapers, a basalt pecking tool, a coral grindstone (weight?), a coral disc, coral balls, a coral pounder, a coral pecking tool, a lime stone pounder, a lime stone adze, a bone tattooing needle, pearl-shell flakes, and basalt flakes. Branch coral files were only collected in Area A and were found in both layers. Items in Area B from the Lower Layer include: a basalt adze, basalt scrapers, a human tooth ornament, pearl-shell flakes, basalt flakes; those from the Upper Layer include: a shell fishhook, basalt adzes, basalt scrapers, pearl-shell flakes, basalt flakes. The distribution of artificial remains was different between the Lower Layer and the Upper layer. Shell artifacts, sea urchin spine artifacts, bone artifacts and pearl-shell flakes were more frequent in the Lower Layer than in the Upper Layer, while basalt artifacts, coral artifacts, limestone artifacts, basalt flakes were more frequent in the Upper Layer than in the Lower Layer. In the total of Area A and Area B, shell artifacts were 5.6% of the total artificial remains in the Lower Layer and 1.9% in the Upper Layer, sea urchin artifacts 1.9% in the Lower Layer and 0.5% in the Upper Layer, bone artifacts 0.9% in the Lower Layer and 0.1% in the Upper Layer, pearl-shell flakes 13.9% in the Lower Layer and 4.0% in the Upper Layer, basalt artifacts 3.2% in the Lower Layer and 4.8% in the Upper

Table 1. Number of artificial remains. Numbers in parentheses are percentages of artificial item to total artificial remains in each layer.

Area	Area A			Area B			total		
layer	lower	upper	?	lower	upper	?	lower	upper	?
shell artifacts									
shell tools									
fish hook (single, double)	12	21			1		12	22	
Terebla shell chisel		1						1	
shell ornament									
pearl shell button		1	1					1	1
Conus shell bead		1	1					1	1
total	12	24	2		1		12	25	2
	[7.1]	*[2.0]*		*[0.0]*	*[1.0]*		*[5.6]*	*[1.9]*	
sea urchin spine artifacts									
file	2	3					2	3	
plaque	2	3	1				2	3	1
total	4	6	1				4	6	1
	[2.4]	*[0.5]*		*[0.0]*	*[0.0]*		*[1.9]*	*[0.5]*	
basalt artifacts									
adze	2	15		1	4		3	19	
drill	1	13					1	13	
scraper	1	26		2	3		3	29	
pecking tool		1						1	
total	4	55		3	7		7	62	
	[2.4]	*[4.6]*		*[6.4]*	*[7.1]*		*[3.2]*	*[4.8]*	
coral stone artifact									
grind stone/weight		1						1	
disc		1						1	
ball		2						2	
Reru (pounder)		1						1	
pecking tool		1						1	
total		6						6	
	[0.0]	*[0.5]*		*[0.0]*	*[0.0]*		*[0.0]*	*[0.5]*	
lime stone artifacts									
Reru (pounder)		1						1	
adze		1						1	
total		2						2	
	[0.0]	*[0.2]*		*[0.0]*	*[0.0]*		*[0.0]*	*[0.2]*	
bone artifacts									
tooth ornament				1			1		
tatooing needle	1	1					1	1	
bone needle									
total	1	1		1			2	1	
	[0.6]	*[0.1]*		*[2.1]*	*[0.0]*		*[0.9]*	*[0.1]*	
pearl-shell flakes	14	43		16	9		30	52	
	[8.3]	*[3.6]*		*[34.0]*	*[9.2]*		*[13.9]*	*[4.0]*	
basalt flakes	134	1067	24	27	81		161	1148	24
	[79.3]	*[88.6]*		*[57.4]*	*[82.7]*		*[74.5]*	*[88.2]*	
remains total	169	1204	27	47	98		216	1302	27
	[100.0]	*[100.0]*		*[100.0]*	*[100.0]*		*[100.0]*	*[100.0]*	

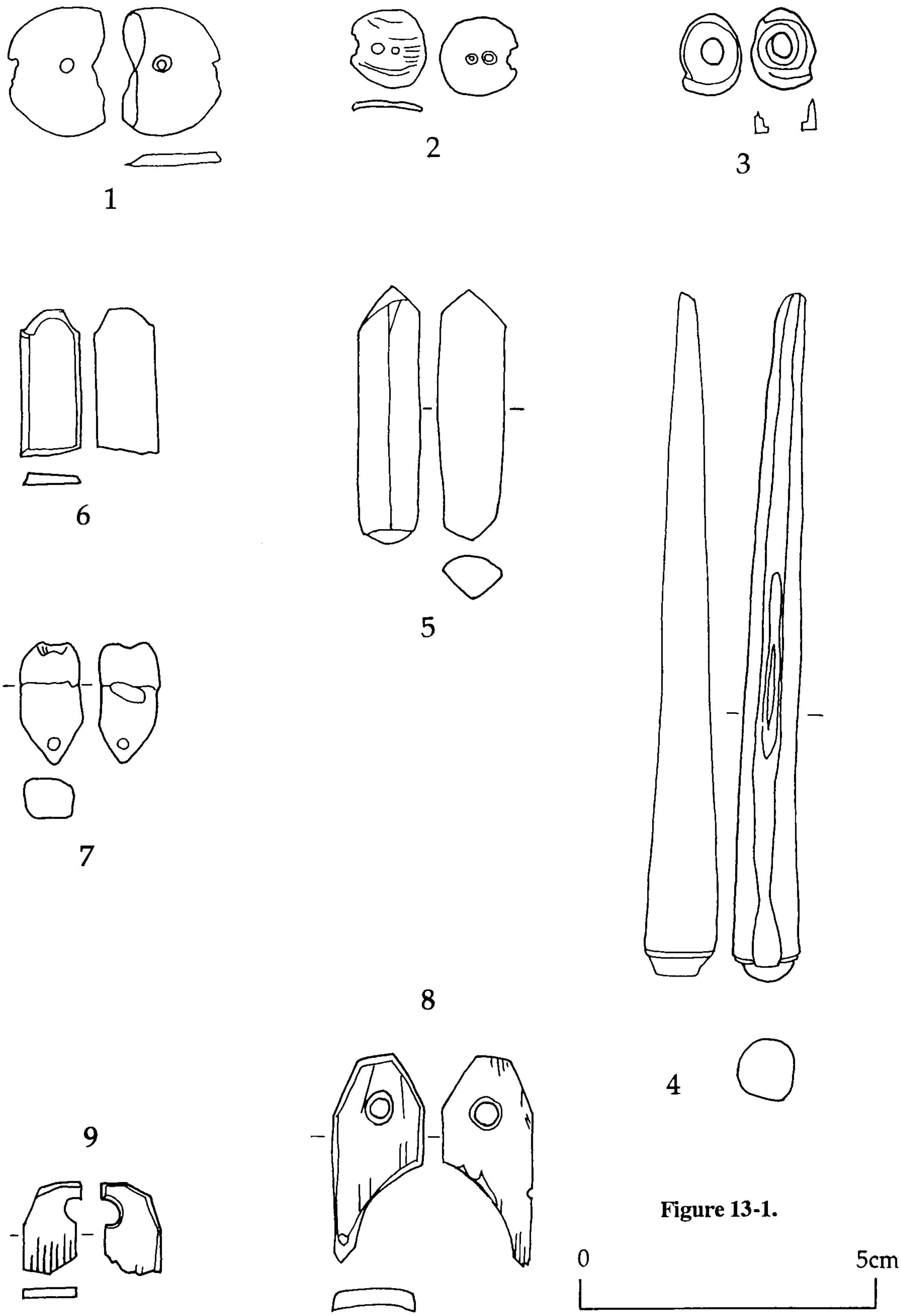


Figure 13-1.

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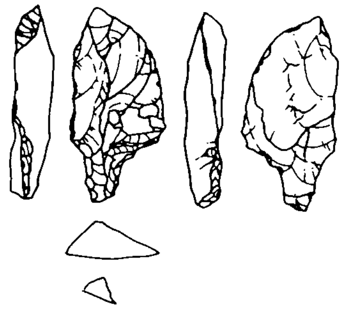

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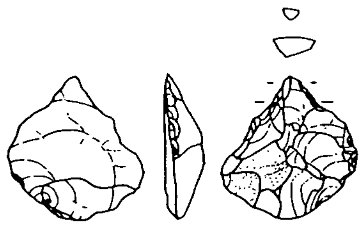

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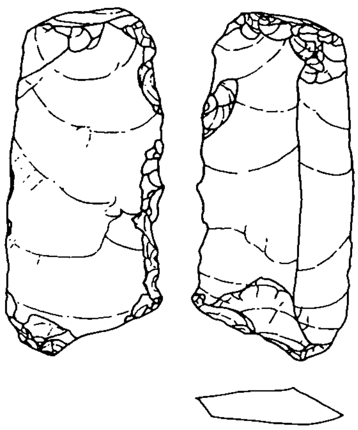

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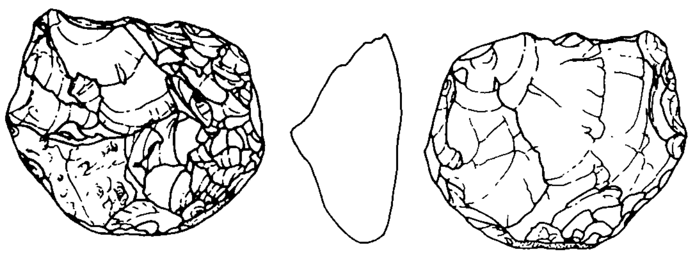

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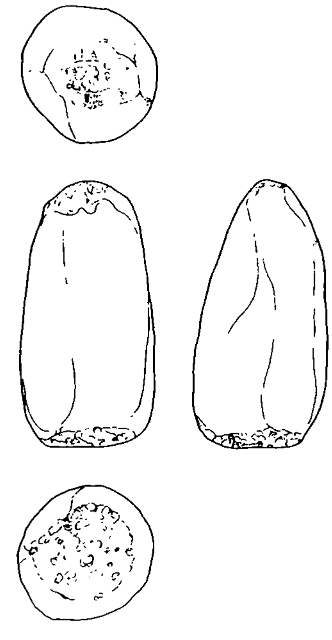

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0 5cm

Figure 13-2.

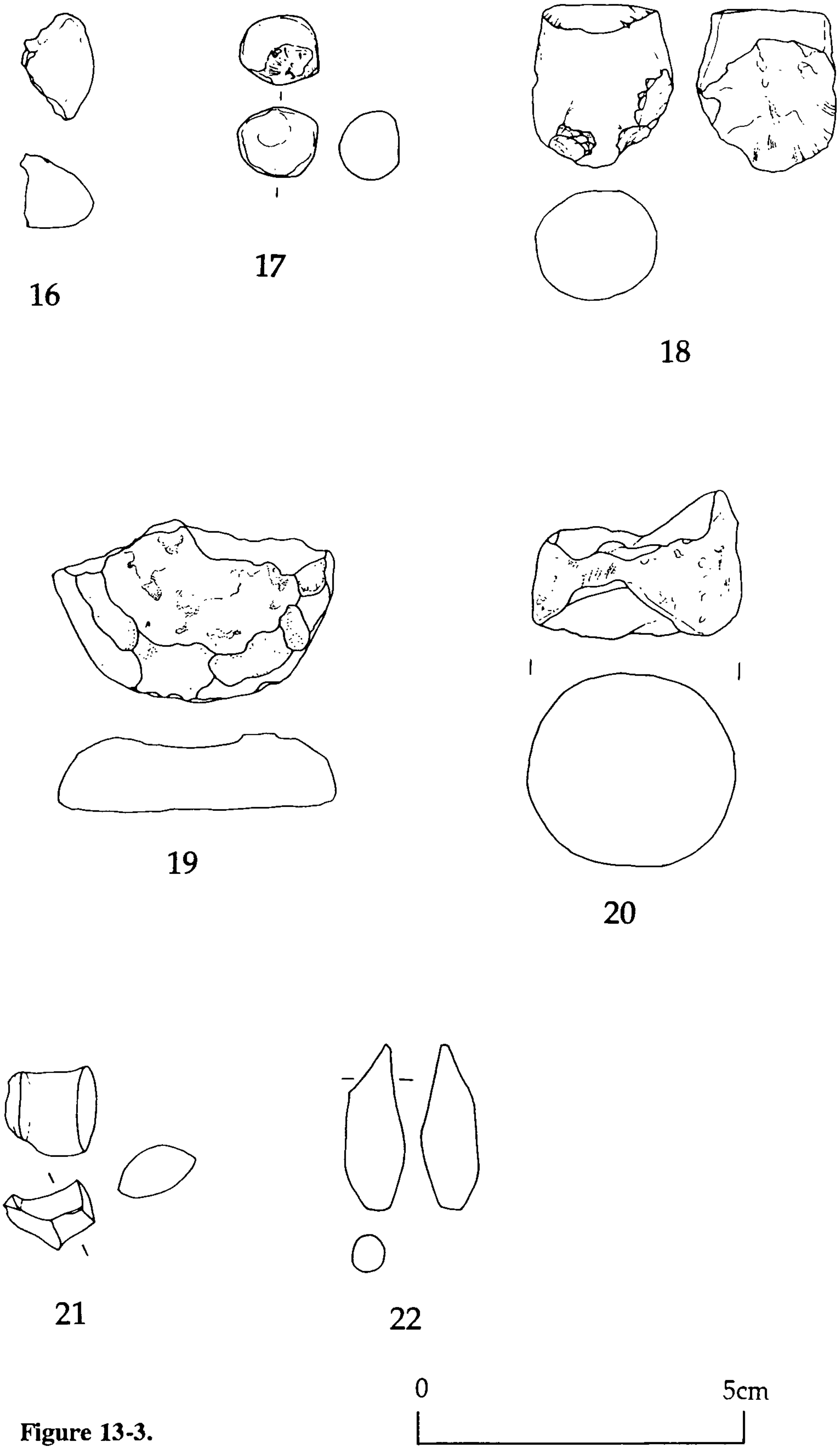

Figure 13-3.

Figure 13. Artifacts excavated from Vairoronga site: 1, Pearl shell button from Upper Layer; 2, Pearl shell button from unknown Layer; 3, Conus shell bead from Upper Layer; 4, Sea urchin spine file from Lower Layer; 5, Sea urchin spine file from Upper Layer; 6, Sea urchin spine plaque from Upper Layer; 7, tooth ornament from Lower Layer; 8, tatooing needle from Lower Layer; 9, tatooing needle from Upper Layer; 10, Basalt adze from Upper Layer; 11, Basalt drill from Upper Layer; 12, Basalt drill from Upper Layer; 13, Basalt scraper from Lower Layer; 14, Basalt pecking tool from Upper Layer; 15, Coral grind stone / weight from Upper Layer; 16, Coral disc from Upper Layer; 17, Coral ball from Upper Layer; 18, Coral pounder from Upper Layer; 19, Coral pecking tool from Upper Layer; 20, Lime stone pounder from Upper Layer; 21, Lime stone adze from Upper Layer; 22, Branch coral file from Upper Layer.

Table 2. Density of faunal remains.

	Area A			Area B			total		
layer	lower	upper	total	lower	upper	total	lower	upper	total
fish bone (g/m³)	36.2	14.2	19.8	37.5	13.9	24.6	36.7 [1.4]	14.1 [0.3]	21.2
used seashell (g/m³)	3056.3	5997.5	5017.1	3683.5	4385.5	4104.7	2599.9 [98.1]	5306.3 [98.9]	4322.1
mammal &bird bone(g/ m³)	15.6	44.4	37.1	10.4	34.9	23.8	13.8 [0.5]	42.7 [0.8]	34.6
total	3108.1	6056.1	5074.0	3731.4	4434.2	4153.1	2650.4 [100.0]	5363.1 [100.0]	4378.0

Used sea shells only include sea shells judged to have been used by inhabitants sampled from four selected squares. Numbers in parentheses are percentages of faunal item to total faunal remains in each layer.

Layer, coral artifacts 0% in the Lower Layer and 0.5% in the Upper Layer, limestone artifacts 0% in the Lower Layer and 0.2% in the Upper Layer, basalt flakes 74.5% in the Lower Layer and 88.2% in the Upper Layer.

Table 2 presents the amount of faunal remains from the Vairoronga site. In Area A from the Lower Layer, fish bones were 36.2 g/m^3, used seashells 3056.3 g/m^3, and mammal and bird bones 15.6 g/m^3; from the Upper Layer, fish bones were 14.2 g/m^3, used seashells 5997.5 g/m^3, and mammal and bird bones 44.4 g/m^3. In Area B from the Lower Layer, fish bones were 37.5 g/m^3, used seashells 3683.5 g/m^3, and mammal and bird bones 10.4 g/m^3; from the Upper Layer, fishbones were 13.9 g/m^3, used seashells 4385.5 g/m^3, and mammal and bird bones 34.9 g/m^3. The distribution of faunal remains differed between the Lower Layer and the Upper Layer. Fish bones were more frequent in the Lower Layer, while used seashells and mammal-bird bones were more frequent in Upper Layer. In the total of Area A and Area B in the Lower Layer, fish bones were 1.4% of the total faunal remains and 0.3% in the Upper Layer, used seashells 98.1 % in the Lower Layer and 98.9 % in the Upper Layer, and mammal and bird bones 0.5 % in the Lower Layer and 0.8 % in the Upper Layer.

DISCUSSION

The excavation findings indicate the function of the site and the subsistence activities of its residents as well as changes in their subsistence activities over time.

I have concluded that people used this place as a multi-functional habitation.

One reason is that during the time that the Lower Layer and the Upper Layer were formed, people likely carried out most subsistence activities around this site. In the time the Lower Layer was formed, people likely used umu ovens as inferred from the excavation of umu ovens and dumps for charcoal and ashes, and they constructed buildings as inferred from the excavation of post holes. In addition, they probably ate shellfish, fish, mammals and birds as indicated from the digging out of shells, fish bones, mammal bones, and bird bones. It was likely that people made and used shell fishhooks as inferred from the excavation of shell fishhooks, shell fishhook preforms, pearl-shell flakes as well as sea urchin spine files, branch coral files, and a basalt drill and drill-shaped basalt flakes, which were possibly used as tools for making fishhooks. People likely made and used basalt tools as inferred from the presence of basalt tools and basalt flakes. They must have carried basalt from inland areas to the site because basalts is only found inland. The people also likely used bone tattooing needles and ornaments.

In the time the Upper Layer was formed, people likely ate shellfish, fish, mammals and birds as inferred from the excavation of their shells and bones. They likely made and used shell artifacts as inferred from the shell artifacts, shell fishhook preforms, pearl-shell flakes as well as sea urchin spine files, branch coral files, basalt drills, and drill-shaped basalt flakes possibly used as artifact-making tools. The residents also must have carried basalt from the inland and made and used basalt tools as inferred from the presence of basalt tools and basalt flakes. The people likely cooked starch foods judging from the presence of coral and limestone pounders, which are though to have been used for preparing starch food(Buck 1944). They probably also used tattooing needles, coral abraders (weights?), coral discs for games (sling stones? or weights?) and coral balls (sling stones? or weights?). The density of artificial remains in the squares where coral stones were gathered is significantly higher than that in the other squares (Mann- Whittny U- test, $p<0.01$). However, in the densities of faunal remains, there is no such difference (Mann- Whittny U- test, $p=0.23$). Hence, I infer that the place around these squares was a kind of workshop where artifacts were actively made.

The other reason why this site is considered to be a multi-functional habitation is that if the site was a fishing camp, tool making would not have been so active.

The Anai'o site is a prehistoric site on Mauke (Walter 1990) in the Southern Cook Islands. Mauke is second closest island to Mangaia and it is 213 km northeast of Mangaia. The calibrated calendar dates of the Anai'o site range from AD 14 to 15C (Walter 1990). This site was a permanent multi-functional habitation where a full range of domestic economic activities, including tool production and maintenance, cooking, food preparation, fishing and agriculture, were carried out (Walter 1990).

Table 3. Numbers of shell fishhooks and basalt adzes from Vaironronga site and Anai'o site arranged by unfinished ones and finished ones.

		Vaironronga lower layer	upper layer	Anaio
hook	unfinished	4	3	25
	finished	6	19	41
adze	unfinished	1	10	3
	finished	2	9	7

The proportion of preforms to finished shell fishhooks and basalt adzes is regarded as an index of tool making activities. Table 3 presents the number of fishhooks and basalt adzes from the Vaironronga site and the Anai'o site arranged by preforms and finished tools. In the

Lower Layer at the Vairoronga site, there were four unfinished fishhooks, six finished fishhooks, one unfinished adze and two finished adzes. In the Upper Layer, there were three unfinished fishhooks, 19 finished fishhooks, ten unfinished adzes and nine finished adzes. At the Anai'o site, there were 25 unfinished fishhooks, 41 finished fishhooks, three unfinished adzes and seven finished adzes. The proportion of preforms to finished tools between the Lower Layer of the Vairoronga site and the Anai'o site is not significantly different for either shell fishhooks or basalt adzes (Fisher's exact probability test, $p=0.58$ and $p=0.71$, respectively). This indicates that during the formation of the Lower Layer at the Vairoronga site, hooks and adzes were made as actively as at the Anai'o site. The proportion of basalt adzes between the Upper Layer of the Vairoronga site and the Anai'o site is not significantly different (Fisher's exact probability test, $p=0.22$), even though the proportion of shell fishhooks is significantly different (Fisher's exact probability test, $p<0.05$). This indicates that during the formation of the Upper Layer at the Vairoronga site, basalt adzes were made as actively as at the Anai'o site.

I have concluded that among the people who lived around the Vairoronga site, fishing activities became less popular and land activities increased as time passed. The reason is as follows. The subsistence activities in the period when the Lower Layer was formed (AD 11-17C) have been compared with those in the period when the Upper Layer was formed (AD 13-20C) by examining the proportion of remains in each layer. The proportions of the artificial remains are significantly different between the layers (Table 1, $\chi^2=62.091$, d. f. $=7$, $p<0.01$). Shell artifacts, sea urchin artifacts, bone artifacts and pearl-shell flakes were more frequent in th´ Lower Layer than in the Upper Layer, while basalt artifacts, coral artifacts, limestone artifacts and basalt flakes were more frequent in the Upper Layer. The proportions of faunal remains significantly differ between the layers (Table 2, $\chi^2=37.892$, d.f.$=2$, $p<0.01$). Fish bones were more frequent in the Lower Layer than in the Upper Layer, while used seashells, and mammal and bird bones were more frequent in the Upper Layer. Since shell fishhooks and fishbones were more frequent in the Lower Layer fishing activities were probably more prevalent during the formation of the Lower Layer. Basalt artifacts, which are tought to have been used for processing wood (Buck, 1944), and mammal and bird bones, were more frequent in the Upper Layer, which probably indicates that land activities were more prevalent during the formation of the Upper Layer.

Kirch et. al. (1991, 1992) has suggested that on Mangaia, there was a progression of forest clearance and increased cultivation from AD 11 to 17C based on their analyses of sedimentary patterns and chronological change in the frequencies of the land snail at the

Tangatatau site. It is very possible that the change in subsistence patterns recognized at the Vaironga site was connected to the increasing forest clearance and cultivation at the Tangatatau site.

Rollet (1989, 1992) has suggested that on Tahuata island in the Marquesas Islands, the importance of offshore fishing declined while that of inshore fishing and agriculture increased from older dates (AD 11-13C) to younger dates (AD 15-20C) based on his investigation of the Hanamiai site. It is possible that land activities developed on Mangaia in the same period when agriculture developed on Tahuata Island.

CONCLUSION

The investigation of the finds from the Vaironga site indicates that prehistoric Mangaians lived in a coastal zone and they used the area as multi-functional habitation throughout the prehistoric period. The people likely used umu ovens, ate shellfish, fish, mammals and birds, made and used shell tools, stone tools, bone tools, shell ornaments and bone ornaments. As time passed, fishing activities became less popular and land activities became more popular. The change in subsistence activity recognized at the Vaironga site were likely connected with the progression of forest clearance and cultivation on Mangaia as indicated by Kirch et. al. (1991, 1992). It is likely that the development of land activities on Mangaia occurred in the same period when agriculture developed on Tahuata Island in the Marquesas Islands as suggested by Rollet (1989, 1992).

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Appendix. Radiocarbon dating of charcoal samples from Vairoronga site

Sample	Layer	14Cage (BP)	Calibrated-age (AD)			probability (%)
1	Lower	1237±116	673	[783]	893	98.7
			938	[ ]	941	1.3
		723±147	1174	[1287]	1404	100
		761±43	1242	[1279]	1290	100
2	Lower	904±84	1043	[ ]	1108	39.4
			1111	[ ]	1149	23.2
			1151	[1164]	1213	37.4
		718±120	1217	[1289]	1400	100
3	Lower	525±122	1298	[1418]	1488	99.4
			1609	[ ]	1610	0.6
4	Lower	784±153	1047	[ ]	1095	15.2
			1116	[ ]	1143	8.7
			1154	[1273]	1310	65.9
			1353	[ ]	1385	10.2
5	Lower	626±158	1222	[1312.1351.1388]	1456	100
6	Lower	861±58	1058	[ ]	1080	12.9
			1124	[ ]	1136	7.3
			1157	[1214]	1257	79.8
7	Lower	539±93	1306	[ ]	1364	40.5
			1375	[1411]	1448	59.5
8	Lower	750±44	1246	[1282]	1294	100
9	Lower	763±47	1237	[1279]	1290	100
10	Upper	549±53	1318	[ ]	1344	30
			1391	[1408]	1435	70
11	Upper	682±57	1283	[1297]	1316	44.9
			1346	[ ]	1391	55.1
12	Upper	205±50	1652	[1671]	1687	28.3
			1736	[1783.1794]	1813	61.5
			1928	[ ]	1942	10.2

(Nakamura and Oda, personal communication)

主論文２

The shell fishhooks excavated at prehistoric sites on Mangaia, Southern Cook Islands

（クック諸島マンガイア島の先史遺跡から出土した貝製釣針の分析）

Prehistoric Mangaians: The People, Life and Language

（１９９８年１２月刊行）印刷中

The shell fishhooks excavated at prehistoric sites on Mangaia, Southern Cook Islands

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Abstract A total of 95 shell fishhooks from the prehistoric living sites on Mangaia , Southern Cook Islands were typologically examined. Thirty five of them were from a coastal site called the Vaironga site; the Upper Layer dates from AD 13 to 20C and the Lower Layer dates from AD 11C to 17C. The remaining sixty hooks were from an island site called the Ngaaitutaki site which dates from AD11 to 17C. By reconstructing the shell hook manufacturing procedure from several stages of preforms, it was found that the people around both sites were making one-piece hooks using a simple drilling method; this method was prevarentin the South Pacific. Examinations of the head forms and fishhook material indicated that the Vaironga people actively interacted with other East Polynesian Islands but that the Ngaaitutaki people did not. Analyses on fishbones and fishhook sizes showed that the Vaironga people carried out both inshore and offshore fishing, while the Ngaaitutaki people mainly did inshore fishing. This study suggested the possibility that on prehistoric Mangaia, there coexsisted several groups that differed in subsistence patterns and the degrees of inter-island interactions.

Key Words: Mangaia, prehistoric living sites, fishhooks, inter-island interaction, fishing

INTRODUCTION

In Polynesia, Tonga and Samoa were settled by the Lapita people 3000 years ago (Green, 1979). However, the subsequent history of the migration and inter-island interaction of the people in Polynesia is still unclear. In order to reconstruct the migration and inter-island interaction, a comparison of fishhooks from prehistoric sites is useful, because fishhooks show huge variation among prehistoric sites in the South Pacific (Emory et al., 1959; Suggs, 1961; Davidson, 1967; Sinoto, 1967, 1968, 1979, 1983a; Kirch, 1993; Rollett, 1989).

By the beginning of the 20th century, unique systems of subsistence, society, and culture had developed on every island in Polynesia (Buck, 1930, 1944, 1957; Handy, 1923). However, the history of the development of such systems on most islands is still unclear. Fishhooks are very useful for reconstructing fishing activities (Walter, 1990; Allen, 1992b; Rollett, 1989), which were one of the most important subsistence activities in Polynesia.

On Mangaia Island in the Southern Cook Islands, large numbers of shell fishhooks were excavated from two prehistoric sites (Igarashi, 1998 in press; Oshima et.al., 1998 in press). The present paper describes the fishhooks excavated from these two sites and reconstructs the manufacturing method of the fishhooks. There is also a discussion of the inter-island interactions between the site inhabitants and people on other islands as well as the fishing activities carried out around these sites.

MATERIALS AND METHODS

The Vairoronga site is located on the northwest coast of Mangaia (Figure 1). Two cultural layers, an Upper Layer and a Lower Layer, were identified. The radio carbon dates of charcoal samples from the Upper Layer are AD 13-20C, and those from the Lower Layer are AD 11-17C (Nakamura and Oda, personal communication). This site was a multi-functional habitation (Igarashi, 1998 in press), where people likely cooked and ate shellfish, fish, birds and animals; in addition, they likely used shell tools including fishhooks, stone tools, bone tools, shell ornaments, and bone ornaments.

The Ngaaitutaki site is located in the eastern area of Mangaia (Figure 1) on the inside of the raised coral reef and in a rock shelter. The radiocarbon dates of charcoal samples from the site are AD 11-17C (Oshima et.al, 1998 in press; Nakamura personal communication). As at Vairoronga site, this site was also a multi-functional habitation, where the people most likely used earth ovens and ate shellfish, fish, birds and animals, and used shell tools such as fishhooks, stone tools, bone tools, shell ornaments, and bone ornaments (Oshima et.al, 1998 in press).

Figure 1. Mangaia Island with Vairoronga site, Ngaaitutaki site and Tangatatau site.

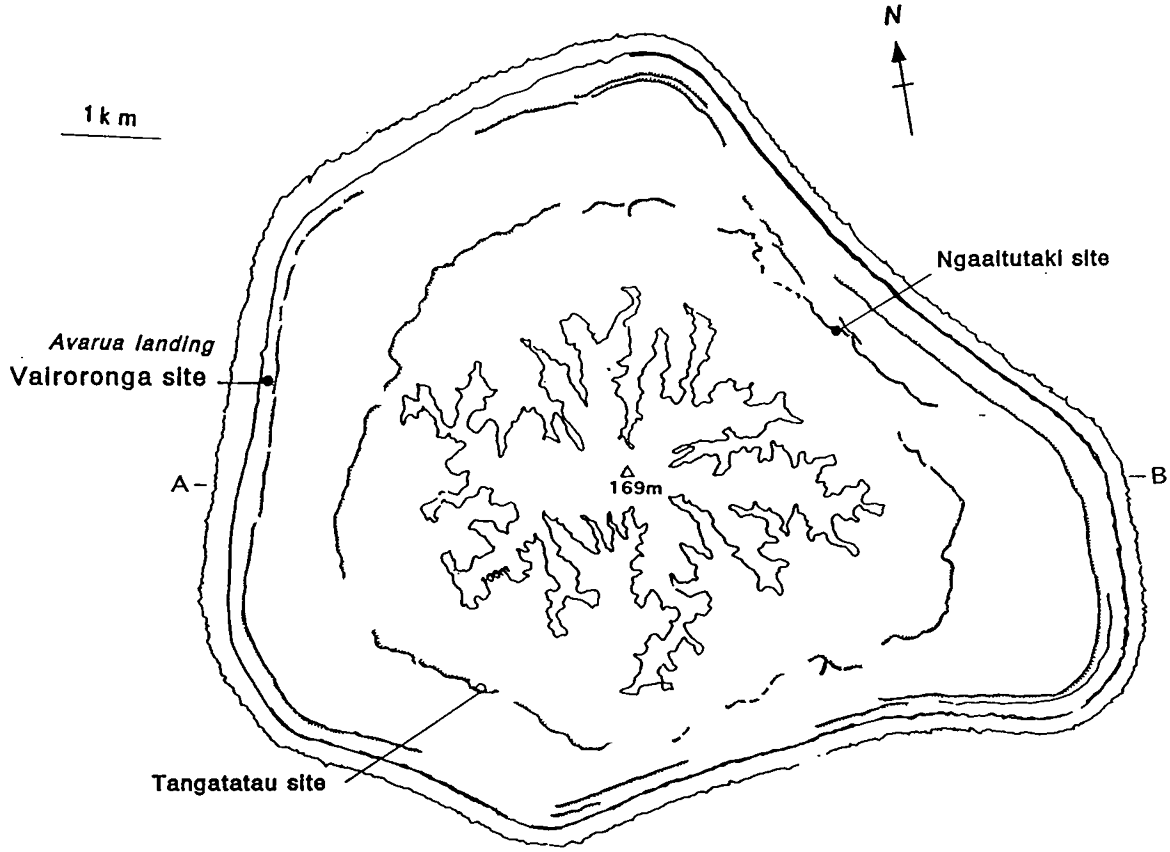

Table 1. Shell fishhooks excavated from Vairornga site and Ngaaitutaki site.

site		
Vairoronga	upper layer	22
	lower layer	12
	unknown	1
	total	35
Ngaaitutaki		60
total		95

Table 1 presents the number of excavated shell fishhooks. A total of 35 fishhooks were excavated at the Vairoronga site: 22 from the Upper Layer, 12 from the Lower Layer, and one from an unknown layer. A total of 60 fishhooks were excavated at the Ngaaitutaki site. Figure 2 and Figure 3 show the drawings of shell fishhooks from the Vairoronga site and Ngaaitutaki site, respectively. Figures 4 and 5 show the plates of the fishhooks from the Vairoronga site and Ngaaitutaki sites.

All hooks are listed in Table 2 with data on site, layer, condition (complete, broken or unfinished), parts of broken one-piece hooks, form, material, head form, shank length, point length, breadth, laterality, and the sharpness of ridges. Fishhooks were classified according to the method by Sinoto (1991) with some modifications. First, hooks were classified as one-piece, two-piece or composite (Table 3). The one-piece hook denotes a hook made of one piece of material, and the parts were designated head, shank, bend, point, point tip and barb (Figure 6a). The two-piece hook denotes a hook in the same shape as the one-piece hook but made of two separate parts: the part of point tip and point and the part of shank and head connected at the bend. The composite hook denotes a hook made of multiple parts, such as the bonito-lure hook (Figure 6b) and octopus-lure hook.

Each one-piece fishhook was classified by a set of five dimensions: form of point and shank, bend form, barb type, material, and head form. Frst, one-piece hooks were classified as a jabbing hook or a rotating hook by the form of point and shank. If the extension of the curvature of the outer contour of the point did not intersect the shank, it was classified as a jabbing hook (Table 3, I-A), and if it intersected the shank, it was classified as a rotating hook (Table 3, I-B). A jabbing hook was characterized by (1) a parallel point and a shank, or (2) a point curved slightly inward towards the shank, or (3) a point curved out. A rotating hook was characterized by (1) a point tip angled inward, or (2) a point curved inward, or (3-A) a shank angled inward, or (3-B) a shank curved inward, or (4) a point and a shank curved inward. Second, the bend form was classified into U type, V type, O type, or L type. Third, the barb type was classified into (1) no barb, (2) inner point barb, (3) outer point barb, (4) lower barb, or (5) inner shank barb. Fourth, the material was identified. Finally, the head form was classified according to the method by Allen (1992a), with some modifications, by a set of three dimensions: a distal end, an inner edge, and an outer edge (Figure 7a). These dimentions were then respectively judged to be flat, concave, pointed, notched, reduced, stepped, or knobbed. Eight types of heads were identified (Figure 7b).

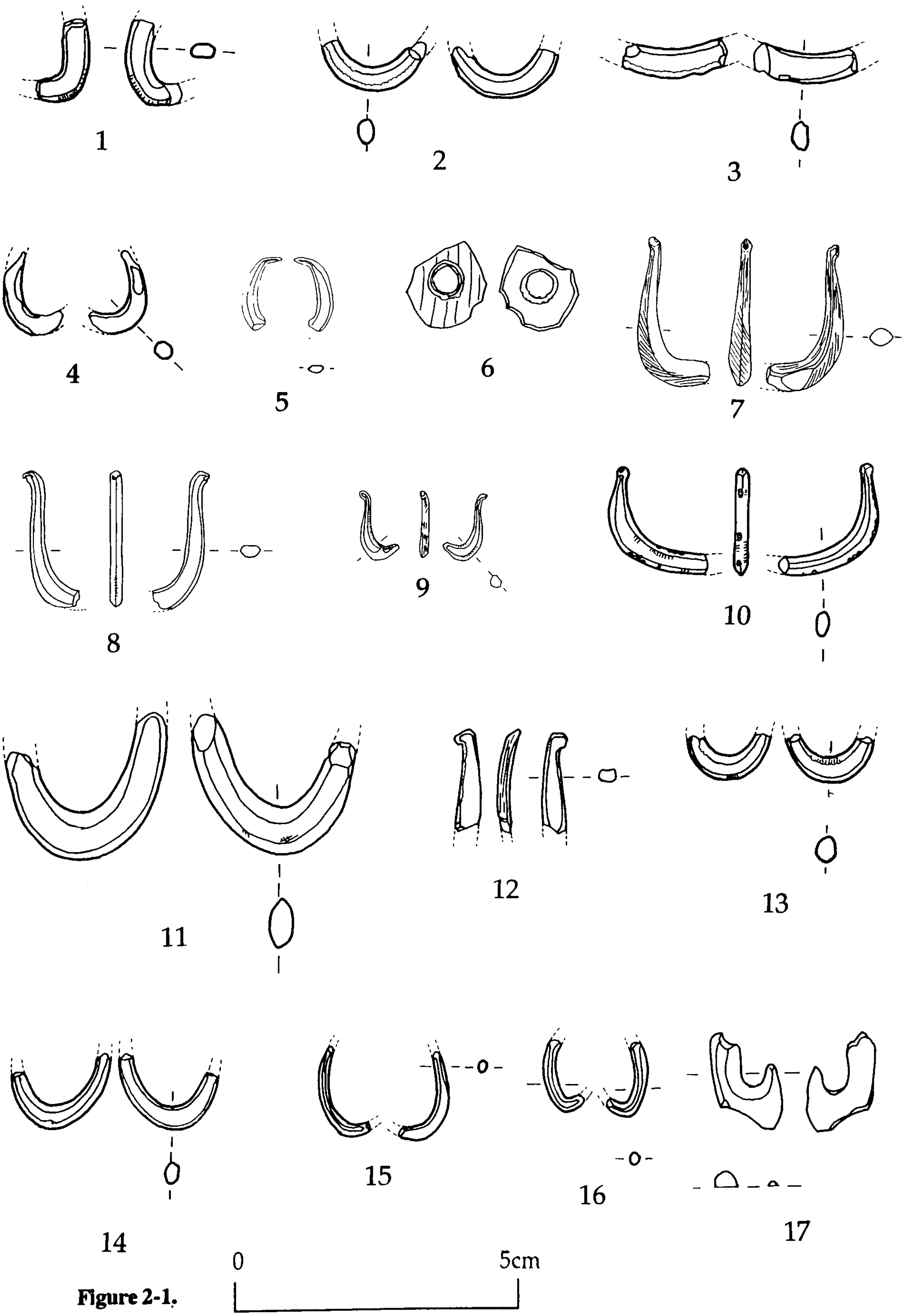

Figure 2-1.

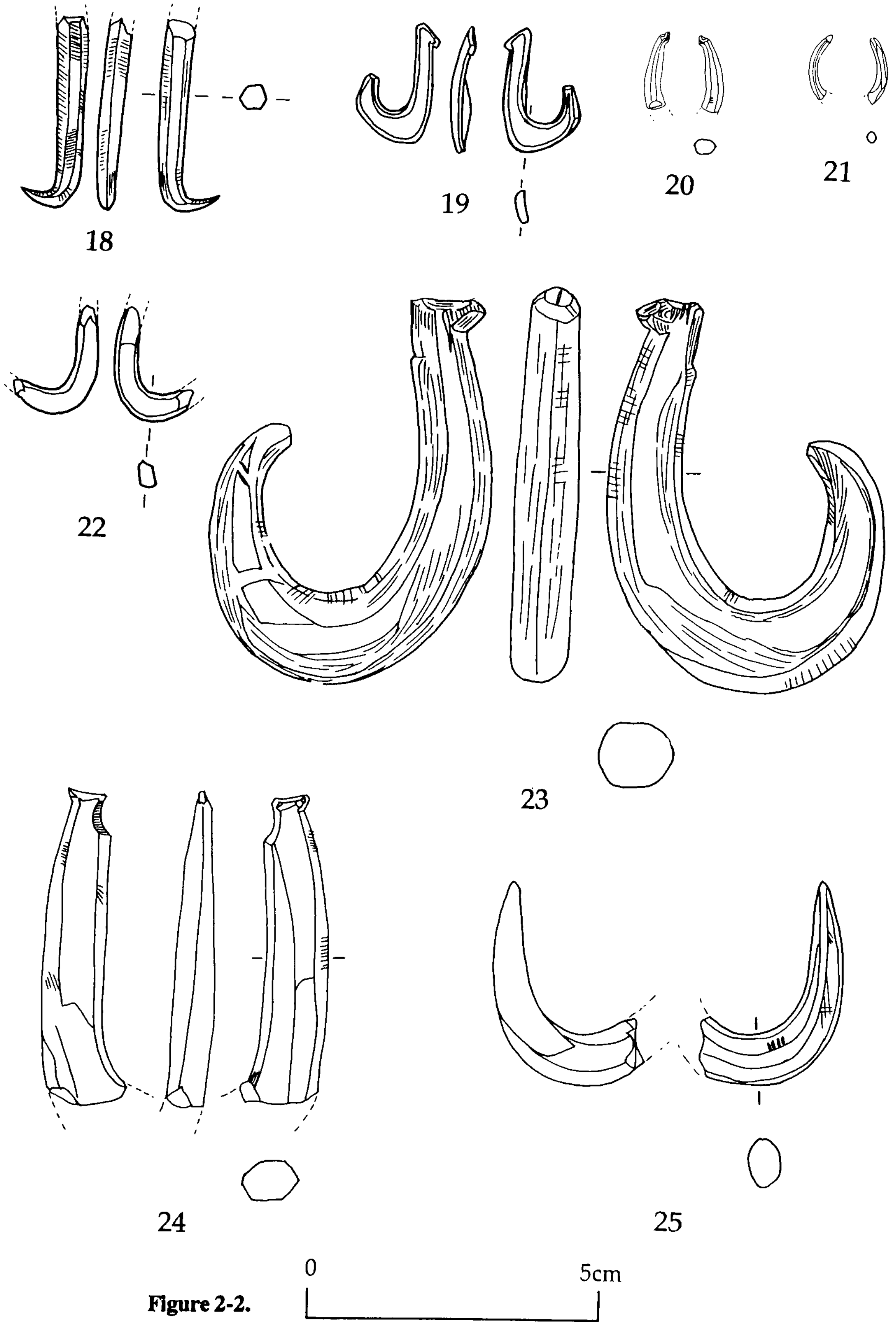

Figure 2-2.

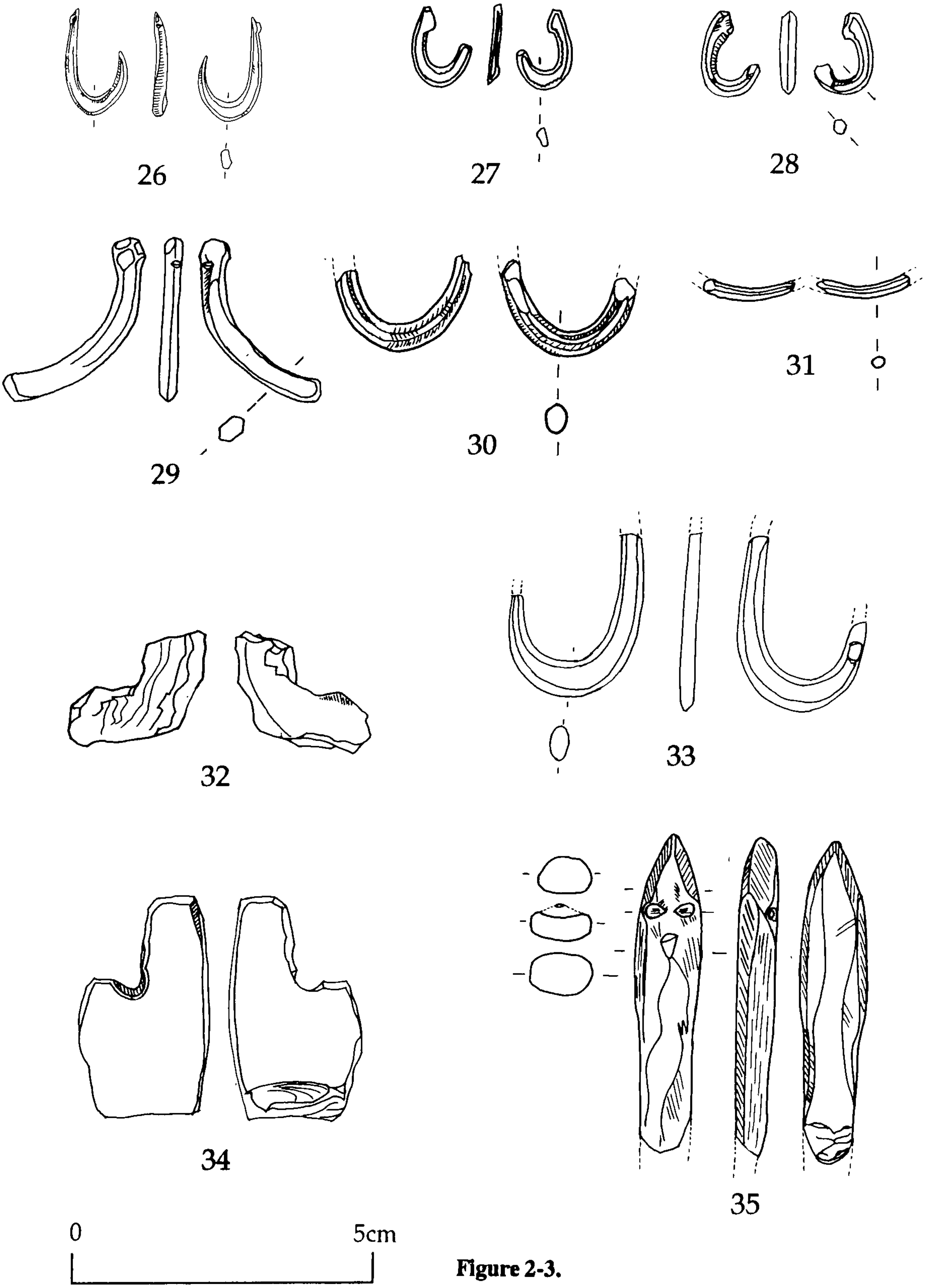

Figure 2-3.

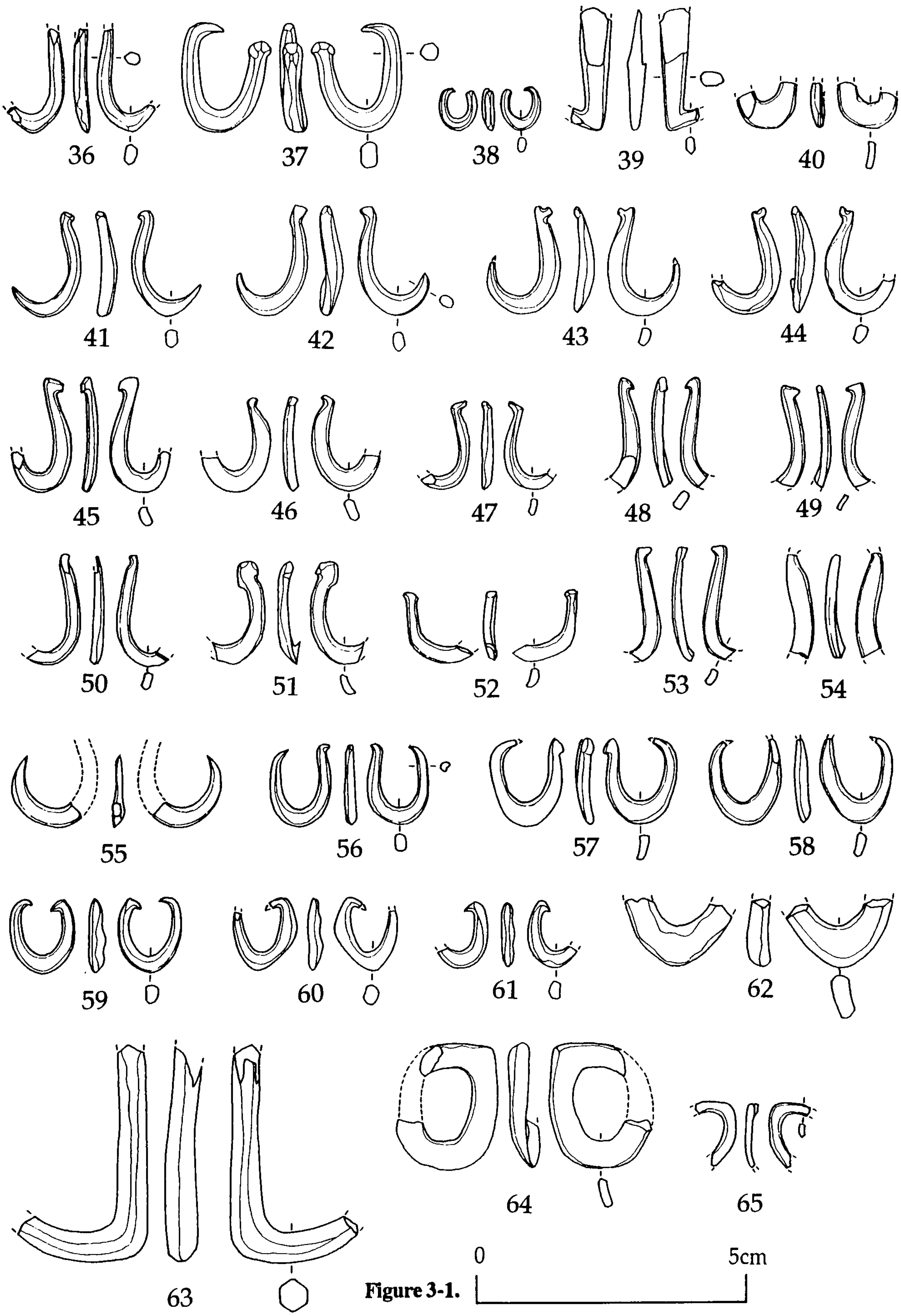
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Figure 3-1.

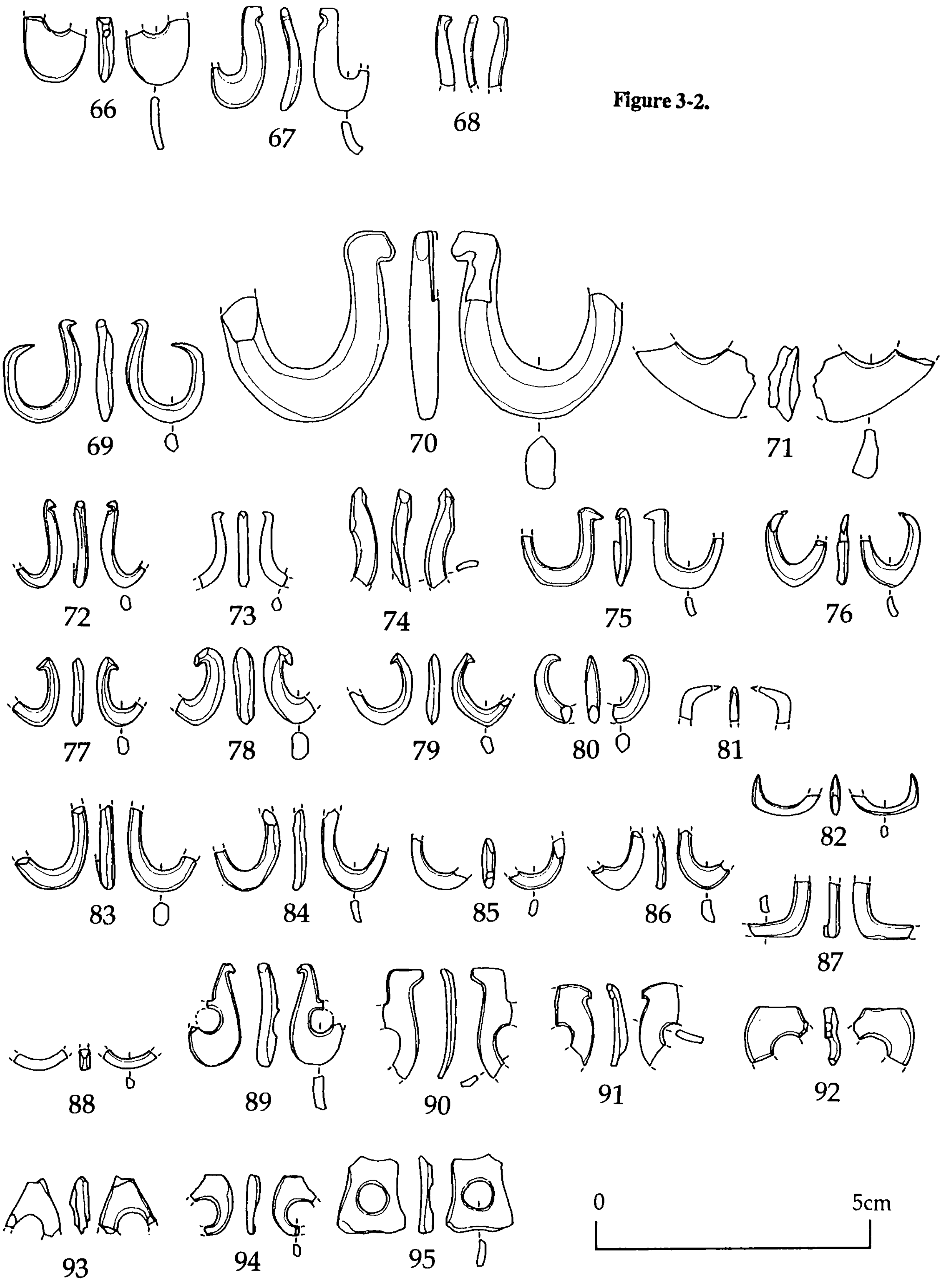
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Figure 3-2.

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Figure 4

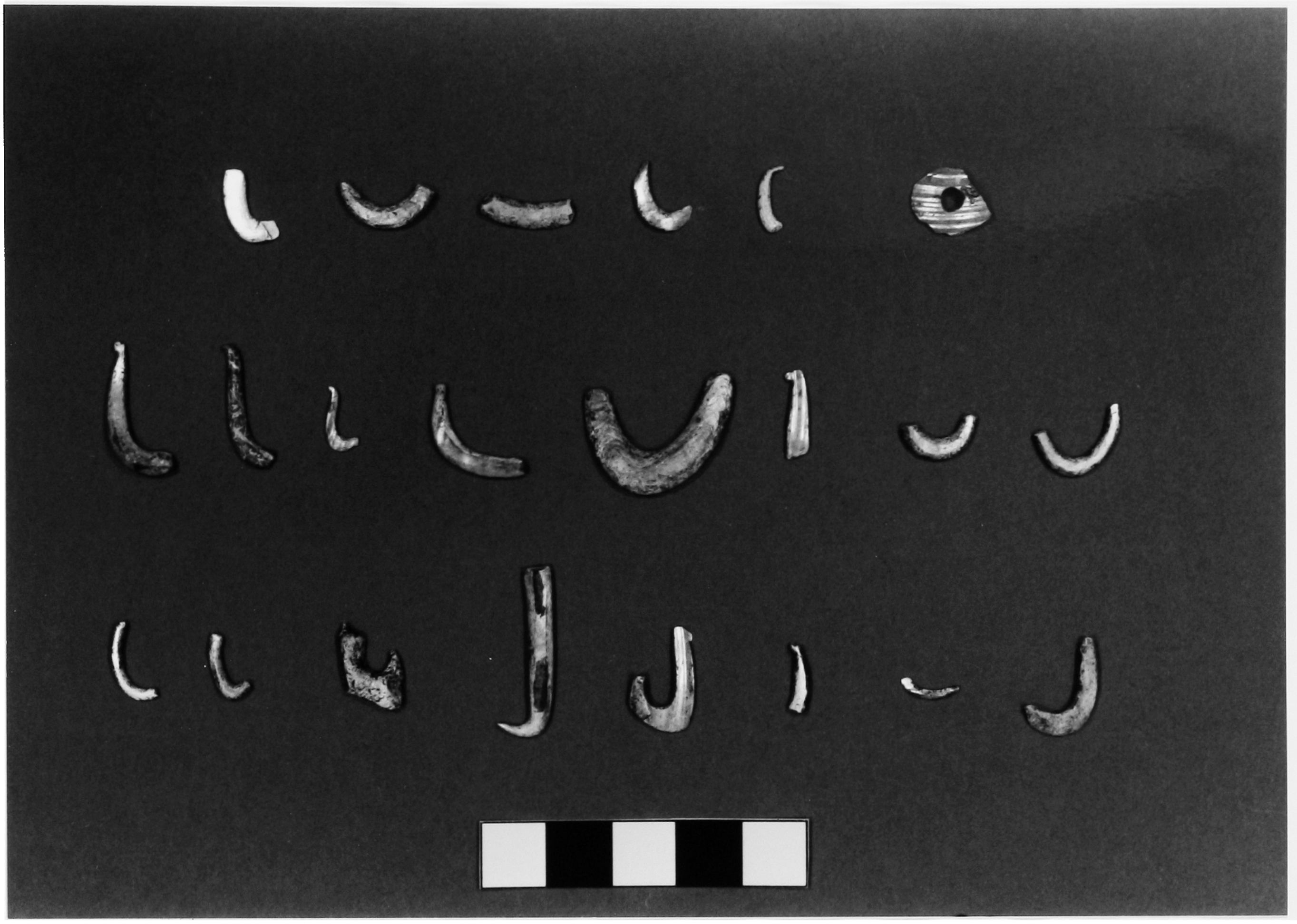

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Figure 5

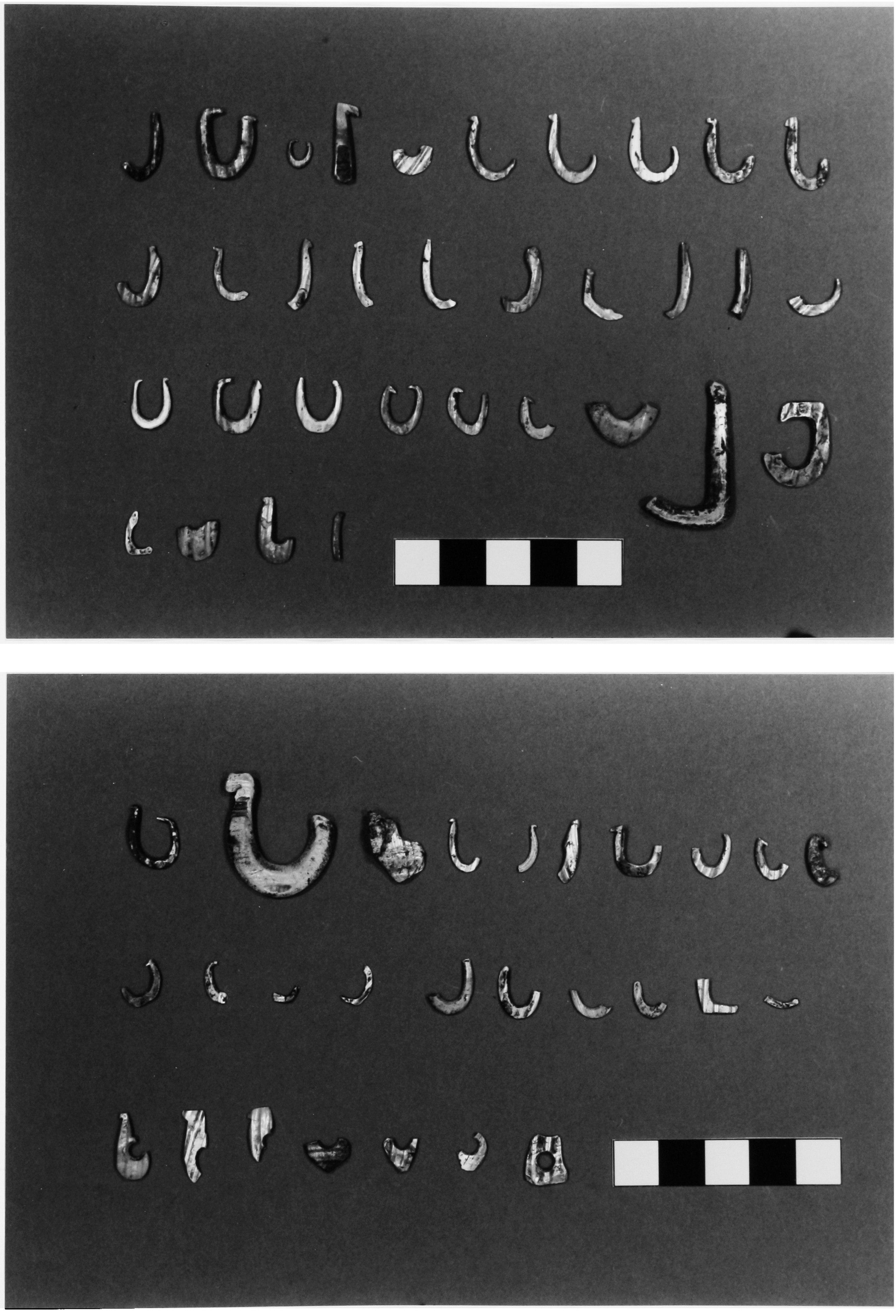


Table 2. Fishhooks with site data, layer, complete, broken or unfinished condition, parts of broken one-piece hooks, form, material, head form, shank length, point length, breadth, laterality, and ridge sharpnes.

Table 2-1.

No.	site	layer	condition	part	form	material	head form	shank length	point length	breadth	laterality	ridge
1	V	U	broken	bc	I	b						D
2	V	U	broken	c	I	b						M
3	V	U	broken	c	I	b						D
4	V	U	broken	bc	I	m						D
5	V	U	broken	d	IB	b					R	M
6	V	U	preform		I	m						
7	V	U	broken	abc	I	b	313	25			L	D
8	V	U	broken	abc	I	b	123	25			L	M
9	V	U	broken	abc	I	m	123	12			L	D
10	V	U	broken	abc	I	b	121				L	D
11	V	U	broken	c	I	b						D
12	V	U	broken	ab	I	m	113				L	M
13	V	U	broken	c	I	b						S
14	V	U	broken	c	I	b						M
15	V	U	broken	bc	I	b						D
16	V	U	broken	bc	I	b						D
17	V	U	preform		I	b						
18	V	U	broken		II or gaff	b						S
19	V	U	preform	abcd	IA1U(1)	m	113	20	12	13	R	
20	V	U	broken	ab	I	b	344				R	D
21	V	U	broken		I	m						D
22	V	U	broken	bc	I	b						D
23	V	L	complete	abcd	IB2O(1)	b	223	68	42	48	R	M
24	V	L	broken	ab	I	b	223	53+			L	S
25	V	L	broken	d	I	b					R	S
26	V	L	complete	abcd	IA1U(1)	m	313	17	11	10	L	M
27	V	L	preform	abcd	I	m		13		9	L	
28	V	L	preform	abcd	I	b		14		10		
29	V	L	broken	abc	I	b	113				R	M
30	V	L	broken	c	I	b						S
31	V	L	broken	bc	I	m						D
32	V	L	preform		I	c						
33	V	L	broken	bcd	I	b		28+		21	R	D
34	V	L	preform		I	b						
35	V	?	broken		III	b		54+				M

Table 2-2.

No.	site	layer	condition	part	form	material	head form	shank length	point length	breadth	laterality	ridge
36	N		broken	bc	I	m					R	D
37	N		complete	abcd	IB1U(1)	m	123	17	20	15	R	D
38	N		broken	abcd	IB4O(1)	m	144	8	8	7	R	D
39	N		broken	ab	I	b	113				R	M
40	N		?	c	I	m						
41	N		complete	abcd	IA3U(1)	m	123	18	7	14	L	M
42	N		complete	abcd	IA1U(1)	m	113	19	8	13	L	M
43	N		complete	abcd	IA1U(1)	m	313	19	10	14	L	D
44	N		broken	abc	I	m	313	18			L	D
45	N		broken	abc	I	m	123	21		11	L	M
46	N		broken	abc	I	m	112	18			R	S
47	N		broken	abc	I	m	113	15			L	M
48	N		preform	ab	I	m	113				R	
49	N		broken	ab	I	m	113				L	M
50	N		broken	bc	I	m		20			L	M
51	N		preform	abc	I	m					R	
52	N		?	abc	I	m					R	
53	N		preform	ab	I	m					L	
54	N		broken	b	I	m					R	M
55	N		broken	cd	I	m					L	M
56	N		complete	abcd	IB1U(1)	b	113	14	14	11		M
57	N		preform	abcd	IB1U(1)	m	113	16	15	13	R	
58	N		broken	bcd	I	m				13	L	M
59	N		complete	abcd	IB4O(1)	m	144	14	14	11	L	S
60	N		broken	abc	I	m	144	14		11	L	D
61	N		broken	abc	I	m	144	12			L	M
62	N		broken	c	I	m						M
63	N		broken	bc	I	b		41+			R	D
64	N		preform		I	m					R	
65	N		?		I	m						
66	N		?	c	I	m						
67	N		preform	abcd	I	m					L	
68	N		broken	ab	I	m	113				R	S
69	N		complete	abcd	IB1U(1)	m	123	18	14	14	L	M
70	N		broken	abc	I	b	123	34		30	L	M
71	N		preform		I	m						
72	N		broken	abc	I	m	123	15			L	M
73	N		broken	abc	I	b	113	13			R	D
74	N		preform	ab	I	m					R	
75	N		preform	abcd	IA1U(1)	m	113	14	10	13	L	

Table 2-3.

No.	site	layer	condition	part	form	material	head form	shank length	point length	breadth	laterality	ridge
76	N		broken	bcd	I	m					L	M
77	N		broken	abc	I	m	144	11			L	S
78	N		broken	abc	I	m	144	14			L	M
79	N		broken	abc	I	m	144	14			R	S
80	N		broken	cd	I	m					R	D
81	N		broken	d	I	m						M
82	N		broken		I	m						M
83	N		broken	bc	I	m						M
84	N		?	bcd	I	m						
85	N		broken	bc	I	m						M
86	N		broken	bc	I	m						M
87	N		broken	bc	I	m						S
88	N		?	bc	I	m						
89	N		preform	abc	I	m					L	
90	N		preform	ab	I	m					L	
91	N		preform	ab	I	m					L	
92	N		preform		I	m						
93	N		preform		I	m						
94	N		preform		I	b						
95	N		preform		I	m						

Site: "V" Vairoronga site, "N" Ngaaitutaki site. Layer: "U" upper, "L" lower. Part descriptions of one- piece hooks follows Sinoto (1991): "a" head, "b" shank, "c" bend, "d" point and point tip. Form descriptions by Sinoto (1991). Material: "b" pearl-shell, "m" *Turbo*. shell, "c" *Chama* shell. All the pearl shells were included in *Pinctada margaritifera* , even though some lacked species' black color. Head form descriptions by Allen (1992) with some modification. If shank is partly broken, shank length is marked with + Laterarlity: "L (left)" shank is on left side and point on right when outer surface faces observers, "R (right)" shank is on right side and point on left when outer surface faces observers. Ridge: "D" dull, "M" moderate, "S" sharp.

next page:Table.3

Table 3. Classification system of shell fishhooks after Sinoto (1991)

I One-piece
II Two-piece
III Composite

I One-piece
  A Jabbing
    1 Point and shank parallel
    2 Point curved slightly inward
    3 Point curved out
  B Rotating
    1 Point angled inward
    2 Point curved inward
    3 point straight
      A Shank angled inward
      B Shank curved inward
    4 Shank and point curved inward

Bend forms of one-piece hooks:
U U-shaped
V V-shaped
O Circular
L L-shaped

Barb types
(1) No barb
(2) Inner point barb
(3) Outer point barb
(4) Lower barb
(5) Inner shank barb

Materials
a mammal bone
b pearl shell
c turtle shell
d metal
e ivory (whale)
f wood
g bird bone
h fish bone
i mammal tooth
j cowrie shell
k stone
m Turbo shell

Figure 6. Parts of the one-piece fishhook (a), and the bonito lure hook (b).

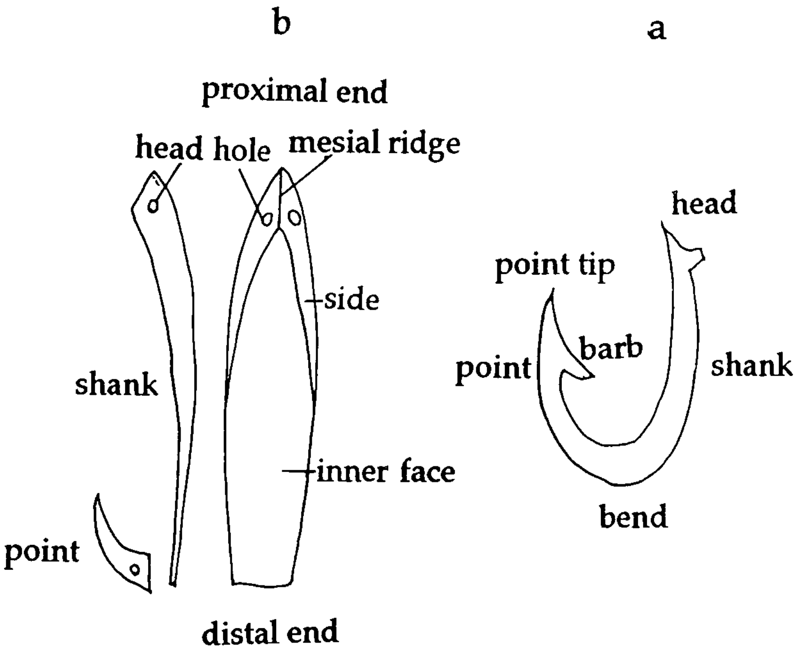
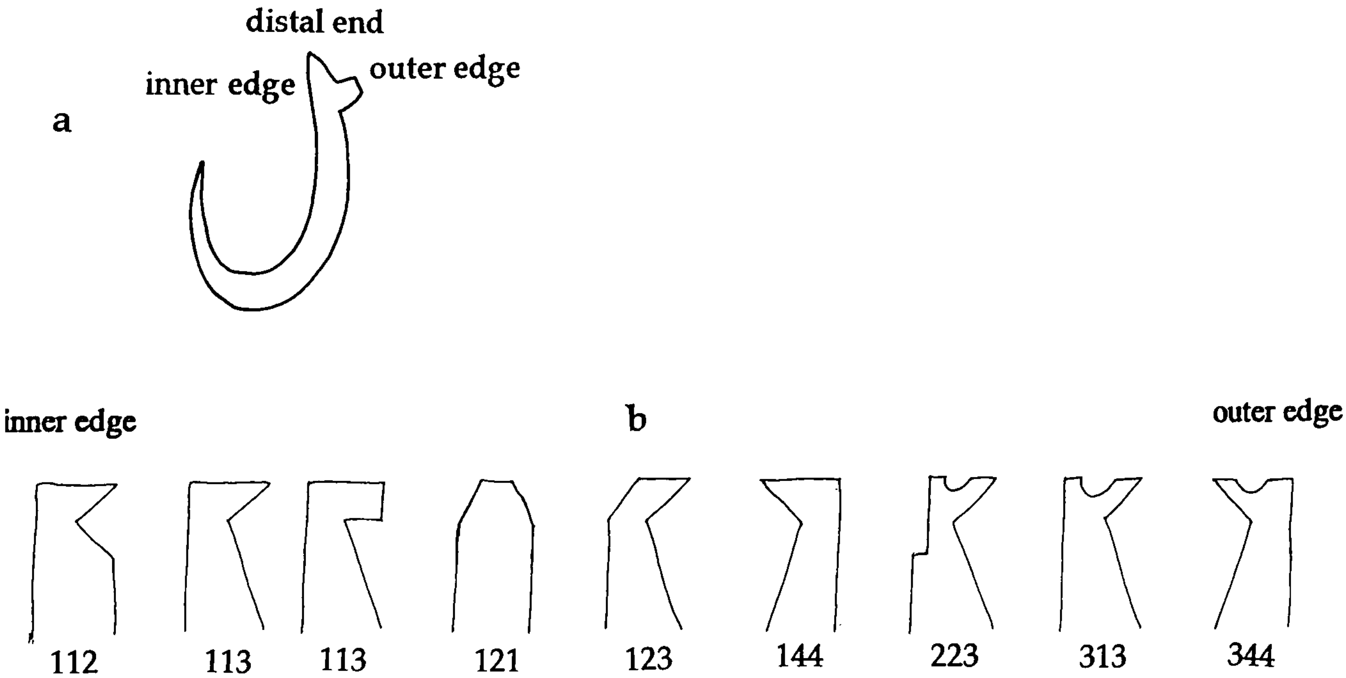


Figure 7. Parts of the head of one- piece hooks (a), and the head form types recognised at the Vairoronga and Ngaaitutaki sites (b).



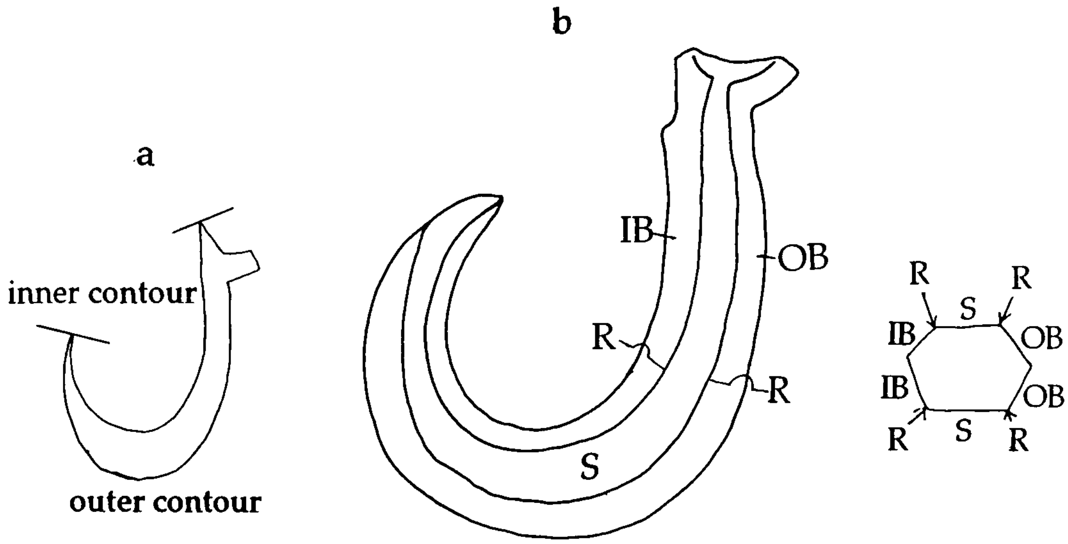
In Class 112, the distal end and inner edge were flat, and the outer edge was notched (Figure 3, No. 46). In Class 113, the distal end and inner edge were flat, and the outer edge was knobbed. The profile of the knob was triangular (Figure 2, No.19, Figure 3, Nos. 42, 47, 48, 49, 57, 75), or square (Figure 2, Nos. 12, 29, Figure 3, Nos. 39, 56, 68, 73). In Class 121, the distal end was flat and the inner and outer edges were reduced (Figure 2, No. 10). In Class 123, the distal end was flat, the inner edge was reduced, and the outer edge was knobbed (Figure 2, Nos. 8, 9, Figure 3, Nos. 37, 41, 45, 69, 70, 72). In Class 144, the distal end and outer edge were flat and the inner edge was knobbed (Figure 3, Nos. 38, 59, 60, 61, 77, 78, 79). In Class 223, the distal end was concave, the inner edge was stepped, s and the outer edge was knobbed (Figure 2, Nos. 23, 24). In Class 313, the distal end was pointed, the outer edge was knobbed, and the inner edge was flat (Figure 2, Nos. 7, 26, Figure 3, Nos. 43, 44). In Class 344, the distal end and inner edge were knobbed, the outer edge was flat (Figure 2, No. 20).

Suggs (1961), Davidson (1967) and Oshima et al. (1998 in press) also classified Polynesian fishhook forms. However, the method in Table 3 more fully documents the variety of fishhook forms.

In order to decide a hook as finished or a preform, the following terms were defined. Shell pieces that were artificially cut with curved edges were designated fishhooks and the others flakes. The contour of a one-piece hook was divided into outer and inner parts (Figure 8a). An outer bevel (OB) is a sloping surface between the shell surface (S) and the outer contour, and an inner bevel (IB) is a sloping surface between the shell surface (S) and the inner contour. A ridge (R) is the line where a bevel meets the shell surface (S). If the contour of a hook was smooth, the contour was designated complete. A hook was designated finished when its outer and inner contours were complete, and its outer and inner bevels were completely formed at the point tip and head. When a hook had no head or point, it was classified as finished if the bevels were completely formed. A finished hook without breakage was classified as complete, and if a finished one lacked some part, it was termed broken.

In order to decide whether a hook was used or not, the sharpness of the ridge was estimated. A ridge was designated "sharp" if it was not worn at all, "dull" if it was discontinuous, and "moderate" in other cases. A hook with a sharp ridge was classified as seldom used, a hook with a dull ridge was classified as frequently used or worn down by sedimentation.

Figure 8. One-piece fishhook.



OB: outer bevel, IB: inner bevel, S: shell surface, R: ridge.

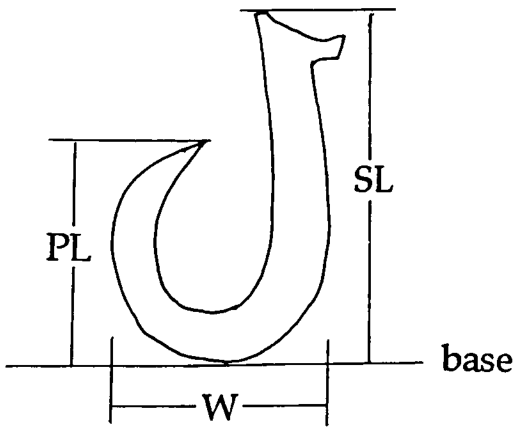
The shank length, the point length, and the breadth of a one-piece hook were measured according to Sinoto's method (1991) (Figure 9). The base is a tangent at the middle of a bend; the shank length (SL) is the maximum length of a shank measured vertically to the base; the point length (PL) is the maximum length of a point measured vertically to the base; the width (W) is the maximum length between the outer contour of a shank and the outer contour of a point parallel to the base. The head part is not included in the width.

The outer surface of *Pinctada margaritifera* is pearly black, and there are furrows on the outer surface of the *Turbo* shell and the *Chama* shell. In order to determine whether the surface color and texture were considered for making fishhooks, the frequencies were compared between the hooks with the shank on the left side and the point on the right side when the outer surface of the shell faces observers, and the hooks with the shank on the right side and the point on the left side when the outer surface of the shell faces observers.

The inter-island interaction and fishing activities of the Vairoronga site inhabitants in the time when the Lower Layer was formed (AD 11-17C) and the Ngaaitutaki site inhabitants (AD 11-17C) was reconstructed by a fishhook analysis and were compared with each other.

The radiocarbon dating of charcoal from the Vairoronga site's Lower Layer coincides with that from the Ngaaitutaki site. However, there are two possibilities considering the wide ranges of charcoal dates from both sites. One possibility is that if the dates of fishhooks from the Lower Layer of the Vairoronga site coincide with those from the Ngaaitutaki site, the inter-island interaction and fishing of the Vairoronga people reconstructed by an analysis of their fishhooks and activities by the Ngaaitutaki people also reconstructed were done in the same period. Another possibility is that if the dates of fishhooks from each site do not

Figure 9. Measuring methods of one-piece fishhook.



SL: shank length, PL: point length, W: width.

completely coincide with each other, the inter-island interaction and fishing of the Vairoronga people and those by the Ngaaitutaki people were done in a different period.

RESULTS

Thirty nine finished hooks were characterized in certain dimensions and their features as well as 23 preforms are listed here. Another 33 hooks without important features were excluded.

No. 5 (Figure 2) is the point of a rotating hook. It is made of pearl-shell and the shank is on the right side when the outer surface of the shell faces observers. The ridge is moderate.

No. 6 (Figure 2) is a preform made of *Turbo* shell with a hole at the center.

No. 7 (Figure 2) is made of pearl-shell with a Class 313 head. The shank length is 25 mm. The shank is on the left side. The ridge is dull.

No. 8 (Figure 2) is made of pearl-shell with a Class 123 head. The shank length is 25 mm. The shank is on the left side and the ridge is moderate.

No. 9 (Figure 2) is made of *Turbo* shell with a Class 123 head. The shank length is 12 mm. The shank is on the left side and the ridge is dull.

No. 10 (Figure 2) is made of pearl-shell with a Class 121 head. The shank is on the left side and the ridge is dull.

No. 12 (Figure 2) is made of *Turbo* shell with a Class 113 head. The shank is on the left side and the ridge is moderate.

No. 17 (Figure 2) is a preform made of pearl-shell with a perforation at the center. The notch is cut from one side into the center.

No. 18 (Figure 2) is a gaff or a point of a two-piece hook. It is made of pearl-shell and its proximal end is broken. The ridge is sharp.

No. 19 (Figure 2) is a preform classified as IA1U(1)m113. The outer and inner contours are complete, and the outer and inner bevels are incomplete. The shank length is 20 mm, the point length is 12 mm, and the breadth is 13 mm. The shank is on the right side.

No. 20 (Figure 2) is made of pearl-shell with a Class 344 head. The shank is on the right side and the ridge is dull.

No. 23 (Figure 2) is a complete hook classified as IB2O(1)b223. The shank length is 68 mm, the point length is 42 mm, and the breadth is 48 mm. The shank is on the right side, the ridge is moderate, and the point tip is round.

No. 24 (Figure 2) is made of pearl-shell with a Class 223 head. The shank is broken and the length is more than 53 mm. The shank is on the left side and the ridge is sharp.

No. 26 (Figure 2) is complete and classified as IA1U(1)m313. The shank length is 17 mm, the point length is 11 mm, and the breadth is 10 mm and the shank is on the left side and the ridge is moderate.

No. 27 (Figure 2) is a preform. The outer contour is complete, the inner contour is incomplete, and the outer bevel is complete at the head and point. It is made of *Turbo* shell. The shank length is 13 mm and breadth is 9 mm. The shank is on the left side.

No. 28 (Figure 2) is a preform. The point tip is broken. The outer contour is complete, the inner contour is incomplete, and the outer bevel is complete at the head. It is made of pearl-shell. The shank length is 14 mm and the breadth is 10 mm.

No. 29 (Figure 2) is made of pearl-shell with a Class 113 head. The shank is on the right side and the ridge is moderate.

No. 32 (Figure 2) is a hook-shaped *Chama* sp. shell. The outer and inner contours are incomplete and no bevel was formed.

No. 33 (Figure 2) is made of pearl-shell. The shank is broken and its length is more than 28 mm. The breadth is 21 mm. The shank is on the right side and the ridge is dull.

No. 34 (Figure 2) is a preform made of pearl-shell with a perforation at the center. The notch is cut from one corner into the center. The wall of the hole is undulated.

No. 35 (Figure 2) is the shank of a bonito-lure hook. It is made of pearl-shell, and the distal end is broken. The upper view of the proximal end is triangular. The shank length is more than 54 mm. The maximum breadth is 11 mm, 27 mm from the proximal end. The thickness is almost even and is 6 mm at its maximum. The head holes are recognized and a mesial ridge is not. The sharpness of the ridge between the inner face and side is moderate. On the inner face, a trace of rubbing is visible along the long axis, and on both sides, the trace of rubbing is vertical to the long axis. This hook was excavated from a burial area.

No. 37 (Figure 3) is a complete hook classified as IB1U(1)m123. The shank length is 17 mm, the point length is 20 mm, and the breadth is 15 mm. The shank is on the right side and the ridge is dull.

No. 38 (Figure 3) is classified as IB4O(1)m144. The inner edge of the head is partly broken. The shank length is 8 mm, the point length is 8 mm, and the breadth is 7 mm. The shank is on the right side. The ridge is dull and the point tip is round.

No. 39 (Figure 3) is made of pearl-shell with a Class 113 head. The shank is on the right side and the ridge is moderate.

No. 41 (Figure 3) is a complete hook classified as IA3U(1)m123. The shank length is 18 mm, the point length is 7 mm, and the breadth is 14 mm. The shank is on the left side. The ridge is moderate and the ridge close to the head is duller than other parts.

No. 42 (Figure 3) is a complete hook classified as IA1U(1)m113. The shank length is 19 mm, the point length is 8 mm, and the breadth is 13 mm. The shank is on the left side. The ridge is moderate and the ridge close to the head is duller than other parts. The point tip is round.

No. 43 (Figure 3) is a complete hook classified as IA1U(1)m313. The shank length is 19 mm, the point length is 10 mm, and the breadth is 14 mm. The shank is on the left side. The ridge is dull. The point tip is round.

No. 44 (Figure 3) is made of *Turbo* shell with a Class 313 head. The shank length is 18 mm. The shank is on the left side and the ridge is dull.

No. 45 (Figure 3) is made of *Turbo* shell with a Class 123 head. The shank length is 21mm and the breadth is 11 mm. The shank is on the left side. The ridge is moderate.

No. 46 (Figure 3) is made of *Turbo* shell with a Class 112 head. The shank length is 18 mm and the shank is on the right side. The ridge is sharp.

No. 47 (Figure 3) is made of *Turbo* shell with a Class 113 head. The shank length is 15 mm. The shank is on the left side. The ridge is moderate. The ridge close to the head is duller than other parts.

No. 48 (Figure 3) is a preform made of *Turbo* shell with a Class 113 head. The outer and inner contours are complete, and the outer and inner bevels are incomplete. The shank is on the right side.

No. 49 (Figure 3) is made of *Turbo* shell with a Class 113 head. The shank is on the left side. The ridge is moderate. The ridge close to the head is duller than other parts.

No. 51 (Figure 3) is a preform made of *Turbo* shell. The outer contour is complete, the inner contour is incomplete, and the outer and inner bevels are incomplete. The point is broken. The shank is on the right side.

No. 53 (Figure 3) is a preform made of *Turbo* shell. The outer and inner contours are complete, and the inner bevel is complete at the head. The shank is on the left side.

No. 56 (Figure 3) is a complete hook classified as IB1U(1)b113. The outside of the head is deeply cut under the knob. The shank length is 14 mm, the point length is 14 mm, and the breadth is 11 mm. The laterality was not determined because the shell's outer surface was impossible to identify. The ridge is moderate.

No. 57 (Figure 3) is a preform classified as IB1U(1)m113. The outer and inner contours are complete, and the outer and inner bevels are incomplete. The shank length is 16 mm, the point length is 15 mm, and the breadth is 13 mm. The shank is on the right side.

No. 58 (Figure 3) is made of *Turbo* shell. The head is broken. The breadth is 13 mm. The shank is on the left side. The ridge is moderate.

No. 59 (Figure 3) is a complete hook classified as IB4O(1)m144. The shank length is 14 mm, the point length is 14 mm, and the breadth is 11 mm. The shank is on the left side. The ridge is relatively sharp.

No. 60 (Figure 3) is made of *Turbo* shell with a Class 144 head. The bend form is an O type. The shank length is 14 mm and the breadth is 11 mm. The shank is on the left side. The ridge is dull. This specimen is possibly the same shape and size as No. 59.

No. 61 (Figure 3) is made of *Turbo* shell with a Class 144 head. The shank length is 12 mm. The shank is on the left side. The ridge is moderate.

No. 63 (Figure 3) is made of pearl-shell. The shank is broken and its length is more than 41 mm. The shank is on the right side. The ridge is dull.

No. 64 (Figure 3) is a preform made of *Turbo* shell with a hole at the center. The shank is on the right side.

No. 67 (Figure 3) is a preform made of *Turbo* shell. The outer contour is complete, the inner contour is incomplete, and the outer and inner bevels are incomplete. The shank is on the left side.

No. 68 (Figure 3) is made of *Turbo* shell with a Class 113 head. The shank is on the right side. The ridge is sharp.

No. 69 (Figure 3) is a complete hook classified as IB1U(1)m123. The outside of the head is deeply cut under the knob. The shank length is 18 mm, the point length is 14 mm, and the breadth is 14 mm. The shank is on the left side. The ridge is moderate.

No. 70 (Figure 3) is made of pearl-shell with a Class 123 head. The shank length is 34 mm and breadth is 30 mm. The shank is on the left side. The ridge is moderate.

No. 71 (Figure 3) is a preform made of *Turbo* shell. The outer and inner contours are incomplete.

No. 72 (Figure 3) is made of *Turbo* shell with a Class 123 head. The outside of the head is deeply cut under the knob. The shank length is 15 mm. The shank is on the left side. The ridge is moderate.

No. 73 (Figure 3) is made of pearl-shell, with a Class 113 head. The outside of the head is cut relatively deeply under the knob. The shank length is 13 mm. The shank is on the right side. The ridge is dull.

No. 74 (Figure 3) is a preform made of *Turbo* shell. The head is broken. The outer contour is complete, the inner contour is incomplete, and the outer bevel is complete at the head. The shank is on the right side.

No. 75 (Figure 3) is a preform classified as IA1U(1)m113. The outer and inner contours are complete, while the outer and inner bevels are incomplete. The shank length is 14 mm, the point length is 10 mm, and the breadth is 13 mm. The shank is on the left side. This specimen is burned.

No. 77 (Figure 3) is made of *Turbo* shell with a Class 144 head. The shank length is 11 mm. The shank is on the left side. The ridge is sharp.

No. 78 (Figure 3) is made of *Turbo* shell with a Class 144 head. The shank length is 14 mm. The shank is on the left side. The ridge is moderate. This specimen is burned.

No. 79 (Figure 3) is made of *Turbo* shell with a Class 144 head. The shank length is 14 mm. The shank is on the right side. The ridge is sharp.

No. 89 (Figure 3) is a preform made of *Turbo* shell. The outer contour is complete, the inner contour is incomplete, and the outer bevel is complete at the head. The shank is on the left side.

No. 90 (Figure 3) is a preform made of *Turbo* shell. The outer contour is complete, the inner contour is incomplete, and the outer and inner bevels are incomplete. The shank is on the left side.

No. 91 (Figure 3) is a preform made of *Turbo* shell. The outer contour is complete, the inner contour is incomplete, and the outer bevel is complete at the head. The shank is on the left side.

Nos. 92, 93 and 95 (Figure 3) are preforms made of *Turbo* shell with a hole in the center. No. 94 (Figure 3) is a preform made of pearl-shell with a hole in the center.

Oshima et.al (1998 in press) classified the hooks from the Ngaaitutaki site. Nos. 41, 42, 43 were classified as Type A; Nos. 56, 57, 69 were classified as Type B; and Nos. 37, 38, 59, 60, 61, 77, 78, 79, 80 as Type C.

One-piece hooks were probably used most at both sites. In the Upper Layer of the Vairoronga site, one hook (No. 18) was a gorge or a point of a two-piece hook, and the others (Nos. 1-17, 19-22) were one-piece hooks. In the Lower Layer, all 12 hooks (Nos. 23-34) were one-piece hooks. One from the unknown layer (No. 35) was a shank of a bonito-lure hook. All 60 hooks were one-piece hooks at the Ngaaitutaki site.

The jabbing hook is suitable on a line with tension in shallow waters, such as for trolling or angling in the reef flat and reef slope. The rotating hook is suitable on a line that cannot be pulled, such as for deep-sea fishing or fishing in strong currents; the rotating hook has the advantage of being seldom caught on rocks (Johannes, 1981). The people of both sites may have used both types of hooks. In the Upper Layer of the Vairoronga site, at least one jabbing hook and one rotating hook were identified, and in the Lower Layer, at least one jabbing hook and one rotating hook were founded. At least four jabbing hooks and six rotating hooks were identified at the Ngaaitutaki site.

The Mangaian people may not have considered the surface color and texture of shells for making fishhooks, which differs from the cases reported on Rennell (Chikamori, 1985) and Anuta (Kirch and Rhosendal, 1973). Thirty-three one-piece hooks had the shank on the left side, and 24 had the shank on the right side. The frequencies of the former and latter are not significantly different from the 50% frequency when the surface color and texture of shells were not considered.

The presence of preforms at both sites supports the conclusion that fishhooks were being manufactured at these sites (Igarashi, 1998 in press). In the Upper Layer of the Vairoronga site, 19 fishhooks were broken and three were preforms, and in the Lower Layer, there were two complete, six broken, and four preforms. The one from the unknown layer was broken. At the Ngaaitutaki site, seven fishhooks were complete, 31 broken, 16 were preforms and six could not be determined.

Hooks with moderate and dull edges at both sites suggest that used hooks were brought back there, which supports the conclusion that these places were not mere workshops but multi-functional living places (Igarashi, 1998 in press). In the Upper Layer of the Vairoronga site, 12 hooks had a dull edge, five a moderate edge and two a sharp edge; in the Lower Layer, two hooks had a dull edge, three a moderate edge, and three a sharp edge. One hook from the unknown layer had a moderate edge. Nine hooks had a dull edge , 23 a moderate edge, and six a sharp edge at the Ngaaitutaki site.

Pearl-shell hooks were more frequent than *Turbo* shell hooks at the Vairoronga site. On the other hand, *Turbo* shell hooks were more frequent at the Ngaaitutaki site. In the Upper Layer of the Vairoronga site, 16 were pearl-shell (*Pinctada margaritifera*) hooks, six *Turbo* shell (*Turbo setosus*) hooks; in the Lower Layer, there were eight pearl-shell hooks, three *Turbo* shell hooks and one *Chama* sp. shell hook. The one from the unknown layer was made of pearl-shell. There were six pearl-shell hooks, and 54 *Turbo* shell hooks at the Ngaaitutaki site.

Class 121 and Class 344 head forms of one-piece hooks were characteristic of the Upper Layer of the Vairoronga site; Class 223 was characteristic of the the Vairoronga site's Lower Layer ; Class 112 and Class 144 were characteristic of the Ngaaitutaki site. In the Vairoronga site's Upper Layer of the, two hooks had a Class 113 head, one a Class 121, two a Class 123, one a Class 313, and one a Class 344; in the Lower Layer, one Class 113, two Class 223, one Class 313, and at the Ngaaitutaki site, one Class 112, ten Class 113, six Class 123, seven Class 144, and two Class 313.

DISCUSSION

(I) Manufacturing method of shell fishhooks

Seven manufacturing methods are known for shell fishhooks from Polynesian prehistoric sites (Sinoto and Kellum, 1965; Sinoto ,1967; Allen, 1992a). In the simple drilling method, the outside edge of a shell tab is filed to form the outer contour of a hook; then, a hole is drilled in the center of the tab, and a notch is filed from the outside edge to form the inner contour of the hook (Sinoto, 1967). In the double drilling method, two holes are drilled instead of one as in the simple drilling method (Sinoto, 1967). Allen (1992a) described preforms with more than three holes, which can be called the multiple drilling method. In the filing and notching method, a deep notch is cut into the tab from the outside edge, and the notch is enlarged to form the inner contour of the hook (Sinoto, 1967). In the chipping and filing method, the outside edge of a large tab is chipped to form the outer contour of a hook, and a hole is drilled in the center of the tab (Sinoto and Kellum, 1965). In the drilling out method, the outside edge of a tab is filed to form the outer contour of a hook; then, the inside of the tab is drilled following the inner contour of a hook, and the center part is broken out (Sinoto, 1967). In the filing out method, the outside edge of a tab is filed or chipped to form the outer contour of a hook; then, the inner contour of a hook is formed by filing from the outer edge into the tab, and then inner piece is filed away (Sinoto, 1967).

The manufacturing method of shell fish hooks utilized by prehistoric Mangaians have been reconstructed. Preforms with a hole in the center (Nos. 6, 17, 34 in Figure 2, Nos. 89, 90, 91, 92, 93, 94, 95 in Figure 3) suggest that the simple drilling method was employed by the people of both sites. Preforms were classified into groups *a* to *e* according to the condition of the contours and bevels (Table 4). Group *a* denotes that the outer and inner contours are incomplete, and the outer and inner bevels are incomplete. Group *b* denotes that the outer contour is complete, the inner contour is incomplete, and the outer and inner bevels are incomplete. Group *c* indicates that the outer and inner contours are complete, and the outer and the inner bevels are incomplete. Group *d* denotes that the outer and inner contours are complete, the inner bevel is complete at the head, and the outer bevel is incomplete. Group *e* denotes that the outer contour is complete, the inner contour is incomplete, the the outer bevel is complete at the head, and the inner bevel is incomplete. The hooks in each group seemed to reflect a certain stage of the manufacturing process.

Table 4. Preforms of one- piece hooks arranged by groups *a-e*.

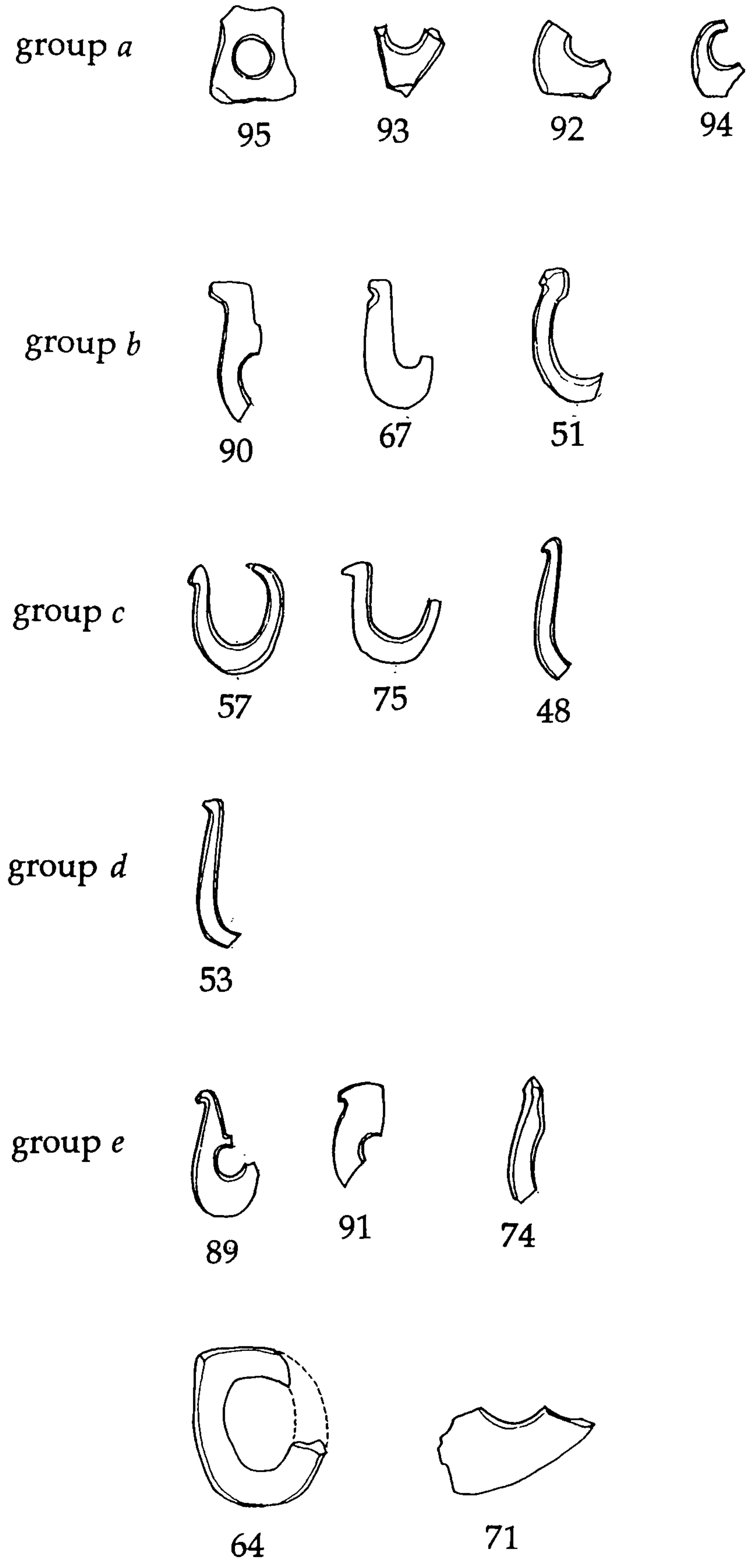
group	outer contour	inner contour	outer bevel	inner bevel	preforms Ngaaitutaki site	Vairoromga site (Turbo shell)	Vairoromga site (pearl shell)	Vairoromga site (Chama sp.)
a	×	×	×	×	95, 93, 92, 94	6	17, 34	32
b	○	×	×	×	90, 67, 51			
c	○	○	×	×	57, 75, 48	19		
d	○	○	×	○	53			
e	○	×	○	×	89, 91, 74	27	28	

○(complete), ×(incomplete).

Two manufacturing processes have been suggested at the Ngaaitutaki site. Figure 10 shows the preforms from the Ngaaitutaki site. The cortex of the shell was removed in all preforms. Method 1 is followed in the stages *a*, *b*, *c*, *d*, and method 2 is *a*, *b*, *e*. In both methods, a tab is perforated in the center (*group a*), a notch is filed from the outer edge, then the outer contour is completed (*group b*). The subsequent steps are different. In Method 1, the inner contour is completed (*group c*), and then the inner bevel is completed (*group d*). In Method 2, the outer bevel is completed before the inner contour is completed (*group e*). Both methods are the same as the simple drilling method except that in these methods, a tab is perforated before its outer edge is filed to form the hook's outer contour Thus, these methods can be called the simple drilling method. Nos. 64 and 71 belonged to group *a* of the simple drilling method or to a step in the double or multiple drilling methods. The simple drilling method was likely the only method utilized at the Ngaaitutaki site because no other methods have been reconstructed from the preforms and shell flakes.

The *Turbo* shell preforms at the Vairoronga site are listed as No. 6 in group *a*, No. 19 in group *c* , and No.27 in group *e*. Thus, *Turbo* hooks were likely made by the simple drilling method of Method 1 or Method 2. For the pearl-shell preforms, No. 17 belongs to group *a*, No. 34 belongs to group *a*, and No. 28 belongs to group *e*. Thus, pearl-shell hooks were more likely made by the simple drilling method. *Chama* shells do not need to be cut like No. 32 in order to be eaten, so, No. 32 is a fishhook preform placed in the filing and notching method. I have concluded that the fishhook makers at both sites most likely mainly used the simple drilling method, which was common in the South Pacific: Nukuoro (Davidson, 1967, 1971), Rennell (Chikamori, 1985), Tikopia (Kirch and Yen, 1982), Ofu

Figure 10. Preforms of one-piece hooks excavated from Ngaaitutaki site.



(Kirch, 1993; Kirch et. al., 1990), Aitutaki (Allen, 1992a), Mauke (Walter, 1990), Rurutu (Verin, 1969), Moorea (Rappaport et al., 1967), Huahine (Sinoto and McCoy, 1974), Nukuhiva (Suggs, 1961), Uahuka (Sinoto, 1967), Hawaii (Sinoto, 1967).

Traces of polishing on hooks suggest that the people at both sites polished preforms utilizing the same steps in hook-making. The polishing traces on preforms (Nos. 6, 92, 93, 94, 95) suggest that when a tab was drilled, the drill was moved along the ridge. The polishing traces on the bevels of the finished hooks (Nos. 18, 23, 24, 25, 26, 30, 46) suggest that the outer and inner bevels were polished at a right angle to the ridge in the finishing stages.

Manufacturing tools necessary for the simple drilling method were found at both sites: basalt flakes, which may have been used for cutting shells (Buck, 1944), basalt drills and drill shaped basalt flakes, which were likely used for drilling shell tabs (Beasley, 1928), and sea urchin spines and branch corals, which were likely used for polishing shell fishhooks (Kirch and Yen, 1982)

(II) Inter-island interaction and subsistence activities at the Vairoronga and Ngaaitutaki sites

The inter-island interaction and fishing activities carried out by the people at the Vairoronga site during the formation of the Lower Layer (AD 11-17C) and at the Ngaaitutaki site (AD 11-17C) have been reconstructed.

The inter-island interaction has been reconstructed from the head form and material of fishhooks. I have concluded that the Vairoronga people actively interacted with other East Polynesians, but there is no evidence that the Ngaaitutaki people actively interacted with the people on other islands.

One reason has been offered by an analysis of the head form. It is reasonable to reconstruct the prehistoric inter-island interactions by comparing the head form of fishhooks on each island, because in ethnographies (Beasley, 1928; Anell, 1955), in many cases, the head of fishhooks were completely covered by fishing line , which suggests that the head form did not directly affect the catch of fishes. Table 5 shows the head types of shell fishhooks excavated from various archaeological sites in South Pacific: Mussau (Kirch, 1987) in Melanesia; Nukuoro (Davidson, 1967, 1971), Rennell (Chikamori, 1985), Anuta (Kirch and Rhosendahl, 1973), and Tikopia (Kirch and Yen, 1982) in Outlier Polynesia; Ofu (Kirch, 1993; Kirch et. al., 1990), Upolu (Davidson, 1969a, 1969b; Janeski, 1980), Niuatoputapu (Kirch, 1988), Tongatapu (Poulsen, 1968) in West Polynesia; in East Polynesia, Pukapuka in the northern Cook Islands(Chikamori, 1988), Aitutaki (Allen, 1992a; 1992b), Mauke (Walter, 1990) in the Southern Cook Islands, Rurutu (Verin, 1969) in the Austral Islads, Maupiti (Emory and Sinoto, 1964), Moorea (Rappaport et al., 1967; Sinoto, 1967), and Huahine (Sinoto and Mccoy, 1974; Sinoto 1983a) in the Society Islands,

Table 5. Head types of shell fishhooks excavated from archaeological sites on islands in South Pacific.

site	Head type									Reference
Mussau		312								(Kirch 1987)
Nukuoro		312		113						(Davidson 1967, 1971)*
Rennell			112	113						(Chikamori 1985)
Anuta		312		113		123				(Kirch and Rhosendal 1973)*
Tikopia		312		113			313			(Kirch and Yen 1982)*
Ofu									344	(Kirch 1993, Kirch et al. 1990)
Upolu										(Davidson 1969a, 1969b; Janetski 1980)
Niuatoputapu		312	112							(Kirch 1988)
Tongatapu										(Poulsen 1968)
Pukapuka				113						(Chikamori 1988)
Aitutaki	223		112	113		123	313			(Allen 1992a, 1992b)*
Mauke	223	312								(Walter 1990)
Mangaia(Vairoronga)	223			113	121	123	313		344	
Mangaia(Ngaaotutaki)			112	113		123	313		144	
Rurutu							313			(Verin 1969)
Maupiti	223									(Emory and Sinoto 1964)
Moorea						123	313			(Rappaport et al. 1967, Sinito 1967*)
Huahine				113		123				(Sinoto and McCoy 1974; Sinoto1983a)
Fakarava etc				113		123				(Sinoto and Kellum 1965)*
Rangiroa				113			313	213		(Garanger 1965)
Mangareva				113		123	313			(Green 1960)
Henderson						123				(Sinoto 1983b)
Tahuata	223			113		123				(Rolett 1989)
Nukuhiva	223			113						(Suggs 1961)*
Uahuka	223		112	113	122				142	(Sinoto 1966, 1967,1968,1970)*
Hivaoa	223			113	122	123			142	(Skjolsvold 1972)
Hawaii		312					313			(Sinoto 1967)*
Kauai etc			112		122		313			(Emory et al. 1959)*
New Zeland	223					123	313			(Duff 1956)*

Islands marked with *: Not all excavated hooks drawn in reports. Comparisons were made by the hooks in the reports.

Fakarava, Raroia, Napuka, Fangatau, Takapoto (Sinoto and Kellum, 1965) and Rangiroa (Garanger, 1965) in the Tuamotu Islands, Mangareva (Green, 1960) in the Mangareva Islands, Henderson (Sinoto, 1983b) in the Pitokain group, Tahuata (Rolett, 1989), Nukuhiva (Suggs, 1961), Uahuka (Sinoto, 1966, 1967, 1968, 1970) and Hivaoa (Skjoldvold, 1972) in the Marquesas Islands, Hawaii (Sinoto, 1967), Kauai, Oahu, Morokai, Ranai, Kahorawe, Maui and Hawaii (Emory et al., 1959) in the Hawaii Islands, and New Zealand (Duff, 1956). Table 5 shows that the hooks with a Class 223 head were excavated from the Vairoronga site's Lower Layer and hooks with this type of head form were identified only in East Polynesia: the Southern Cook Islands (Vairoronga site on Mangaia, Aitutaki, Mauke), the Society Islands (Maupiti), the Marquesas Islands (Tahuata, Nukuhiva, Uahụka, Hivaoa) and New Zealand. The No. 23 hook with a Class 223 head from the Vairoronga site's Lower Layer most resembles a hook from Nukuhiva Island in the Marquesas (Suggs, 1961; Figure 26 i). Both are classified as IB2O(1)b223. The No. 23 hook also resembles another hook from Nukuhiva Island(Suggs, 1961; Figure 26 h), which is classified as IB2V(1)b223. Thus, this indicates that the Vairoronga inhabitants were in contact with inhabitants of East Polynesia. Table 5 also shows that the hooks with a Class 223 head were not excavated at the Ngaaitutaki site, and hooks with a Class 144 head were only found at the Ngaaituaki site. Thus, this finding does not suggest that the Ngaaitutaki people actively interacted with people on other islands.

Another reason has been offered by an analysis of the material. The Vairoronga people likely used pearl-shell fishhooks more frequently than *Turbo* shell fishhooks, while the Ngaaitutaki people likely used *Turbo* shell fishhooks more frequently than pearl-shell fishhooks. This is because the ratios of pearl-shell hooks and *Turbo* shell hooks are significantly different between the Vairoronga site's Lower Layer and the Ngaaitutaki site (Fisher's exact probability test, $p<0.01$). The pearl-shell is not found in Mangaia today. In the Northern Cook Islands and Tuamotu Islands, the pearl-shells grow abundantly (Sims, 1988), and they grow to some extent in the Marquesas Islands (Sinoto, personal communication), and Rarotonga and Aitutaki in the Southern Cook Islands (Walter, 1990). Therefore the prehistoric Mangaians probably introduced pearl-shells or pearl-shell hooks from these islands. The *Turbo* shell, on the other hand, now grows on Mangaia, which suggests that prehistoric Mangaians could also have obtained *Turbo* shells in Mangaia. Thus, the Vairoronga people could have actively introduced pearl-shells or pearl-shell fishhooks from other islands in East Polynesia such as the Northern Cook, the Tuamotu, the

Marquesas, or other Southern Cook islands. On the other hand, no one has suggested that the Ngaaitutaki people actively interacted with other islanders.

Fishing activities have been reconstructed from fishbones and fishhook size. I have

Table 6. Fish families caught by present day Mangaians and fishing place and method.

	inshore			offshore		
	reef flat	reef flat & reef edge	reef slope			
	netting	angling	spear gun	trolling	shallow angling	deep sea angling
Acanthridae	○	○	○			
Aulostomidae	○					
Balistidae	○	○				
Belonidae						
Carangidae	○					○
Cirrhitidae		○				
Coridae/Labridae	○	○			○	
Coryphaenidae				○		○
Diodontidae						
Epinephelidae		○				○
Exocoetidae						
Gemphylidae						○
Hemilamphidae	○	○				
Holocentridae				○		
Kyphosidae		○	○		○	○
Leptocephalidae						
Lethrinidae	○					
Lutjaenidae						
Mugilidae	○					
Mullidae	○	○				
Muraenidae		○				
Pempheridae		○		○		
Priacanthidae				○		
Scaridae			○			
Scombridae				○		○
Siganidae	○	○	○		○	
Sparisomidae						
Sphyraenidae				○		
Teleostomi						

○(employed more than once).

concluded that the Vairoronga people carried out both inshore and offshore fishing, while the Ngaaitutaki people mainly carried out mainly inshore fishing according to the analysis of fish bones.

The folloeing fish species were excavated at the Vairoronga site: *Epinephelidae*, *Labridae*, *Lethrinidae*, *Scaridae*, *Scombridae* and *Elasmobranchii*. Table 6 shows the fish families caught by present-day Mangaians and the place and method for catching them recorded during four months in 1991, 1992, and 1993. Judging from the fishing methods of the present-day Mangaians, the Vairoronga people likely caught *Epinepheridae* by inshore angling or offshore deep-sea angling, *Labridae* by inshore netting or inshore angling or offshore shallow angling, *Lethrinidae* by inshore netting, *Scaridae* by spears at the reef slope, and *Scombridae* by offshore trolling or offshore deep sea angling. Table 7 presents the MNI (minimum number of identified) of the fish families calculated from the fish bones excavated at the Ngaaitutaki site (Leach et al., 1994). The most dominant families are *Balistidae*, *Epinephelidae*, *Labridae* and *Muraenidae*, and no large offshore fishes such as *Scombridae*

Table 7. MNI (minimum number of identified) of fish families calculated from fish bones at the Ngaaitutaki site (Leach et al. 1994).

	MNI	%
Balistidae	55	42.3
Epinephelidae	19	14.6
Coridae/Labridae	15	11.5
Muraenidae	9	6.9
Diodontidae	7	5.4
Holocentridae	4	3.1
Scaridae	4	3.1
Lutjaenidae	3	2.3
Mullidae	3	2.3
Leptocephalidae	3	2.3
Lethrinidae	2	1.5
Teleostomi	2	1.5
Acanthridae	1	0.8
Belonidae	1	0.8
Carangidae	1	0.8
Sparisomidae	1	0.8
total	130	100.0

are listed. Again, judging from the fishing methods of present-day Mangaians, Ngaaitutaki people likely caught *Balistidae* by inshore netting or inshore angling. They fished for *Epineprhridae* by inshore angling or offshore deep-sea angling, *Labridae* by inshore netting, inshore angling or offshore shallow angling, and *Muraenidae* by inshore angling.

An analysis of fishhook sizes supports the belief that the Vairoronga people caught both inshore and offshore fish while the Ngaaitutaki people caught mainly inshore fish.

Table 8. Shank length of shell fishhooks excavated from Vairoronga site and Ngaaitutaki site.

		Vairoronga [upper layer]		Vairoronga [lower layer]		Ngaaitutaki	
shank length	average	20.5	[4]	32.2	[6]	17.4	[24]
	minimum	12		13		8	
	maximum	25		68		41	
	S.D.	6.14		23.08		6.98	

Hooks marked with + in Table 2 included in calculation. Numbers in parentheses are sample number. S.D. is standard deviation.

The Vairoronga people likely used a greater variety of shell fishhook sizes than the Ngaaitutaki people. Table 8 presents the shank length of one-piece hooks from both sites. The average shank length is 20.5 mm in the Vairoronga site's Upper Layer of (range = 12 to 25 mm, SD = 6.14, N=4), 32.2 mm in the Lower Layer (range= 13 to 68 mm, SD = 23.08, N=6), and 17.4 mm at the Ngaaitutaki site (range= 8 to 41 mm, SD = 6.98, N=24). The variance in shank length is larger in the Vairoronga site's Lower Layer than that in the Ngaaitutaki site, and the difference is statistically significant ($F=10.940$, $p<0.01$). An investigation of 44 jabbing hooks now used by Mangaians has shown that fishhook size corresponds to angling methods and angling zones. Twelve hooks with shank lengths from 16 mm to 29 mm are used for inshore angling. Twelve hooks from 33 mm to 45 mm in length are used for inshore angling, offshore deep-sea angling and offshore trolling. Twenty hooks from 47 mm to 123 mm length are used for offshore deep-sea angling and offshore trolling. Large fish, like *Coryphaenidae*, *Scombridae*, *Sphyraenidae* and

Gemphylidae are cought only with the largest hooks. Thus, the Vairoronga people utilized a greater variety of angling methods and angling zones than the Ngaaitutaki people, which supports the results of fishbone studies that showed the Vairoronga people caught both inshore and offshore fish while the Ngaaitutaki people mainly caught inshore fish.

Around the beginning of the 20th century, Mangaians used large wooden hooks with shank lengths from 7 to 20 cm for offshore fish such as *Gemphyridae* and *Elasmobranchii* (Buck, 1944). There is a possibility that prehistoric Mangaians also used large wooden hooks for offshore fish. Thus, the Ngaaitutaki people could have caught large offshore fish if they used large wooden hooks. However, no offshore fish were found at the Ngaaitutaki site. This indicates that the Ngaaitutaki people chose not to do fish offshore as the Vairoronga people did.

The charcoal radiocarbon dates from both sites are of a wide range, so two possibilities can be considered. One possibility is that the age of fishhooks from the Vairoronga site's Lower Layer coincides with that from the Ngaaitutaki site, which means the inter-island interaction and fishing by the Vairoronga inhabitants and the Ngaaitutaki inhabitants were conducted in the same period. In this case, it is suggested that during AD 11 to 17C, there coexisted some groups that differed in the pattern of fishing activities and the degree of inter-island assocoation on Mangaia: the Vairoronga people actively interacted with people on other islands and fished both inshore and offshore, while the Ngaaitutaki people may not have actively interacted with people on other islands and did mainly inshore fishing. Another possibility is that the ages of fishhooks from each site do not completely coincide with each other, which means that the inter-island interaction and fishing by the Vairoronga people and those by the Ngaaitutaki people were done in different periods. Especially in the case when the activities of the Vairoronga people were older than those of the Ngaaitutaki people, this study supports the estimation by Kirch et al. (1992) that by ca. 700BP, Mangaia became disengaged from the long distance exchange network evidenced at the Tangatatau site on Mangaia (AD 11C to 17C).

CONCLUSION

The investigation of shell fishhooks from the Vairoronga site and Ngaaitutaki site shows that most hooks were the one-piece type and the people living around both sites likely made one-piece hooks using the simple drilling method broadly prevalent in the South Pacific. An investigation of the head form and material of fishhooks and fishbones indicates that the people at the Vairoronga site in the age when the Lower Layer was formed actively interacted with people on other islands in East Polynesia, the Vairoronga inhabitants carried out inshore and offshore fishing, and the people at the Ngaaitutaki site mainly carried out inshore fishing. The analysis does not show evidence that the Ngaaitutaki people actively interacted with other islanders. This study proposes the possibility that on prehistoric Mangaia, some groups coexisted such as the Vairoronga people and the Ngaaitutaki people who had different subsistence patterns and different degrees of inter-island interactions.

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主論文３

先史ポリネシア人の貝利用
-南太平洋クック諸島マンガイア島の先史遺跡から出土
した貝殻遺物の分析-

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The Exploitation of the Shell by the Prehistoric People on Mangaia

-An Analysis of the Marine Molluscan Remains Excavated at Vairoronga Site on Mangaia, Southern Cook Islands-

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キーワード

・ポリネシア　・マンガイア島　・先史時代　・生活遺跡　・貝利用

・裾礁　・マルサザエ

要旨

　南太平洋クック諸島マンガイア島の、先史生活遺跡出土の海産貝殻と、現生貝を分析した結果、遺跡の人々は裾礁全体を利用して貝を採集し、大型の貝種を選択的に利用し、マルサザエを重用していた、と推定できた。人々は、島で手に入る貝資源を無駄なく効率的に利用するという形で、島嶼環境に適応していたと考えられる。

目次

一　はじめに

ポリネシアは、ハワイ、ニュージーランド、イースター島を結ぶ三角形に囲まれた地域である（図１）。ここには火山島や環礁島など、大きさや地形の異なる多数の島が点在している。

ポリネシア先史学における未解決の重要なテーマの一つは、人々の初期移住に関する問題である。約３０００年前に、ポリネシア西部のトンガとサモアに、ポリネシア人の祖先であるラピタ人[Green 1979:49]が西方から移住してきた[Kirch and Hunt 1988:22]。しかしその後の移住の経路や時期については見解が定まっていない。

もう一つの重要なテーマは、島嶼環境への適応過程の問題である。ポリネシア西部にいた１つの祖先集団[Kirch and Green 1987:434]の子孫が島々に移住した後、それぞれの島嶼環境で独自の文化や社会を築き上げたことは、１５世紀の航海者の記録や２０世紀初頭の民族誌から読みとれる[Beaglehole and Beaglehole 1938、Buck. 1932.など]。しかしその過程については、ニュージーランド[Davidson 1984]、ハワイ諸島[Kirch 1985]、マルケサス諸島[Kirch 1980]などをのぞき、多くの島では明らかにされていない。

周りを海に囲まれた島嶼環境においては、貝は魚とならんで身近な海産資源であったことは想像に難くない。実際に南太平洋の先史生活遺跡からは貝殻遺物や貝製品が豊富に出土する。そしてそれらは、先史時代の生活を推定する有力な手がかりとなることがわかってきた。たとえば貝殻遺物の分析によって、人々の食事内容[Kirch and Yen 1982:303-305]、貝の採集場所[Allen1992: 364-370]、他の島との交流の様子[Walter 1990: 237-238]、人々が自然環境に与えた影響[Kirch et.al 1992: 174]など

が解明された。また、貝製品や加工痕のある貝殻遺物の分析は、人々の漁労活動[Rollet 1989: 268-271、Igarashi 1998a]、食物加工[Walter 1990: 201]や他島との交流[Allen 1992:318-319、Igarashi 1998a]の様子などを明らかにした。

筆者らは１９９１年と１９９３年に、クック諸島マンガイア島でワイロロガ先史遺跡の発掘調査を行った。本稿では、この遺跡から出土した海産貝殻遺物を分析する。それと同時にマンガイア島の現生貝についても分析を行うことによって、今までの研究よりも実証的かつ詳細に、遺跡を遺した人々の貝利用の様子を推定し、その特徴と適応的意味を明らかにする。

二　マンガイア島とワイロロガ遺跡

クック諸島はポリネシアのほぼ中央に位置し、北グループの６島と南グループの９島からなる１５の島で構成されている（図１）。マンガイア島は、南グループの最南端（南緯２１度、西経１５７度）に位置し、最も近いラロトンガ島（クック諸島の首都）とは２０４キロメートル離れている。島の月平均気温は摂氏２１度から２７度の間である[Clark 1981]。面積は５１・８平方キロメートルであり、人口は１９９１年には１２１４人であった。

島の地形は中央部の火山円錐丘（標高１６９メートル）と、それを囲む隆起サンゴ礁段丘（マカテア）からなる（図２）。マカテアは幅が２５０から２０００メートル、標高は最高７０メートル[Marshall 1927: 20]である。現在の集落は島の西海岸（マカテアの外側）、および島の南部と東部のマカテアの上にある。内陸部（マカテアの内側）の湿地帯

ではタロイモが栽培され、湿地帯の周辺やマカテアの上ではパンノキ、サツマイモ、陸生タロイモ、ヤムイモ、キャッサバ、ココヤシなどが収穫されている。

マンガイア島の周囲の裾礁は、幅が１５０から３００メートル、最深部の深さが１メートル[Marshall 1927: 11]であり、ポリネシアでは中規模である。礁池や干瀬（図３）では網や釣竿や手掴みでボラ、ニザダイ、アジ、ヒメジ、ハタ、ベラ、ムロアジなどが捕れ、礁斜面ではブダイなどが潜水漁で捕れる（写真１）。外洋では底釣りやトローリングでカマス、カツオ、イットウダイ、クロタチカマスなどが捕れる。また礁池や干瀬や礁斜面では貝が採集されている（写真２）。

ワイロロガ遺跡は、マンガイア島の北西海岸に位置する（図２）。遺跡は墓域と居住域からなる。居住域では上下２層の遺物包含層が認められ、木炭の炭素年代は、上層でAD １３－２０世紀、下層でAD １１－１７世紀である。この年代値から、ワイロロガ遺跡は、マンガイア島にすでに人々が定着していた時期[Kirch et al. 1991:323, Igarashi 1998a]の遺跡であることがわかる。発掘面積は２７・３平方メートルである。全ての土（１６立方メートル）を、３・２ミリメートルと１・６ミリメートルのメッシュの二重の篩にかけて、出土遺物を採集した。それらは貝殻（海産および陸産）、魚骨、鳥骨、獣骨、貝製品（釣針、ノミ、装飾品、加工片）、石製品（石器、加工片）、骨製品である[Igarashi 1998b]。

海産貝殻は膨大な出土量となり、また層ごとに均一な密度と種構成で堆積していた。そこで人工遺物が最も多く出土した区域（面積４平方メートル、体積２・２立方メートル）の貝殻についてのみ分析を行った。ただし上層には、撹乱により下層の遺物が混入している可能性がある[Igarashi, 1998b]ので、本稿は、下層で出土した貝殻の分析結果だけを扱

う。

三　先史マンガイア島民の貝利用に関する分析

１　出土した貝種と重量

まず、出土した貝殻から貝種を同定した。用いた図鑑は、生物大図鑑貝類[奥谷ほか1986]、沖縄海中生物図鑑[岡本1988]、世界海産貝類図鑑[アボットとダンス1985]である。種が同定できないものは、属または科のレベルで分類した。次いで分類群ごとに貝殻の出土重量を計った。

表１に、同定した貝の分類名と分類群ごとの出土重量を示す。巻貝は２１科２７種、二枚貝は１３科１０種が同定できた。出土重量が最も多かったのはマルサザエで、それに続いてコオニノツノガイ、シラナミガイ、オオウラウズガイ、シシガシラザル、シロイガレイシガイまたはキマダライガレイシガイ、ムカシタモトガイ、リュウキュウヒバリガイ、リュウキュウマスオガイが多かった。

２　確実に利用されたと推定される貝種

遺跡から出土した貝殻は、必ずしも人に利用されたものばかりとは限らない。海岸に自然堆積した貝殻が、大波によって打ち上げられたり、サンゴ砂利に混ざって住居の床に敷かれたりするからである。そこで、人々が利用した貝種を判定するために、次の分析を行った。

まず、遺跡から出土した貝殻を角型と丸型に分類し、種ごとに各型の個数を求めた。角型とは表面も割れ口も磨耗していない貝殻（完形また

は破片）であり、丸型とは表面や割れ口が磨耗している貝殻（完形または破片）である（写真３）。海岸に自然堆積した貝殻の多くは波の作用で丸型になり、人が利用して遺跡に廃棄した貝殻は角型であろうと考えられる。次いで、海岸に自然堆積した貝殻を採集し、角型と丸型の割合を求めた。そして遺跡から出土した貝種のうち、角型の割合が、海岸に自然堆積した貝殻の値より有意に高いことが確実な種を、人々が利用した種と判定した。

海岸に自然堆積した貝殻は、次のように採集した。オネロア、アラオア、カランガヌイ水路の３ヶ所の海岸（図２）で、満潮線より高位の地表に１メートル×１メートルのグリッドを１個設定し、グリッド内に堆積した貝殻のうち、篩にかかる大きさ（直径約２ミリメートル以上）のものを全数採集した。これら３カ所の海岸で採集した貝殻を一括して、角型と丸型の割合を求めた。その結果、海岸に自然堆積した貝殻では、角型の割合は２１・４パーセント（角型６６個、丸型２４３個）であった。

遺跡から出土した貝殻について、種ごとの角型の個数と丸型の個数、そして角型の割合を表１に示す。遺跡から出土した３７種の貝のうち、角型の割合が海岸の値より有意に高い種は、マルサザエ、オオウラウズガイ、コオニノツノガイ、ムカシタモトガイ、シロイガレイシガイまたはキマダライガレイシガイ、マダライモガイ、コマダライモガイ、リュウキュウヒバリガイ、シシガシラザル、シラナミガイ、アラヌノメガイ、リュウキュウマスオガイであった。しかし、そのうちの４種に関しては、角型の割合が海岸の値より有意に高いことが確実ではない可能性が残っている。遺跡から出土した貝殻で種が同定できなかったものが、全て丸型だったからである。マダライモガイとコマダライモガイが属するイモ

ガイ科では、全体の８７パーセント（２４１・２グラム）の貝殻が丸型で、種が同定できなかった。その中にはマダライモガイやコマダライモガイが含まれていようから、この両種における角型の割合は、海岸の値より高くない可能性がある。さらに、シロイガレイシガイとキマダライガレイシガイが属するアクキガイ科でも、全体の２６パーセントにあたる６９・７グラムの貝殻が丸型で、科しか同定できなかった。その中にはシロイガレイシガイやキマダライガレイシガイが含まれていようから、この両種においても角型の割合が海岸の値より高くない可能性がある。しかしその他の９種が属する科には、種が同定できなかった貝殻はなかった。

したがって、少なくともこれら９種の貝、マルサザエ、オオウラウズガイ、コオニノツノガイ、ムカシタモトガイ、リュウキュウヒバリガイ、シシガシラザル、シラナミガイ、アラヌノメガイ、リュウキュウマスオガイについては、遺跡の人々が確かに利用した種と判定してよいだろう。なお、海岸ごとの角型の割合は異なっていたが、これら９種の角型の割合は、いずれの海岸の値よりも高かった。これら９種の貝は、遺跡から出土した貝種のなかで、出土重量が１番目から５番目、７番目から９番目、および１５番目に多かった。それらの総出土重量は２１７６・８グラムで、遺跡から出土した貝種全体の６５パーセントに上った。出土重量が多いことも、これら９種が利用されていたことを示す傍証となろう。

３　貝の利用方法

これら９種の貝は、現在のマンガイア島民にとって重要な食用種であることから、遺跡の人々もこれらを食用としていたと考えられる。現在

のマンガイア島民は、マルサザエの殻を割って貝肉を食べ、オオウラウズガイやコオニノツノガイの殻頂部を打ち欠いて貝肉を吸い出す。遺跡から出土したマルサザエもほとんどが割れており、オオウラウズガイやコオニノツノガイも多くは殻頂部が欠けていることから、これらの貝は現在と同じ方法で食用にされたのであろう。またマルサザエは現在釣り餌としても用いられており、先史時代にも同じ用途で利用された可能性もある。

ワイロロガ遺跡からは多くのマルサザエ製釣針が出土している[Igarashi 1998a]が、同種の貝殻のいくつかは、大きさや形から、未完成の釣針や釣針製作時の副産物であると考えられる。シシガシラザル、シラナミガイ、リュウキュウマスオガイ、アラヌノメガイなどの二枚貝については、２０世紀初頭のマンガイア島民が二枚貝をスクレイパーとして用いていた[Buck 1944:23]り、サモアやクック諸島のペンリンでリュウキュウマスオガイがスクレイパーとして用いられていた[Buck 1930:285; 1932:103]ことから、スクレイパーとして用いられていた可能性がある。さらにプカプカの事例[Beaglehole and Beaglehole 1938:71]から、二枚貝はおろし器、ナイフ、外科刀などとしても利用された可能性がある。またマンガイア島での現在の利用法から類推して、シラナミガイは器として、その他８種の貝は首飾りや衣装飾りとしても利用されていた可能性がある。

４　貝の採集場所

遺跡の人々が裾礁のどこで貝を採集したかを、現生貝の生息条件から推定した。

マンガイア島の裾礁は、地形的には、岩棚（または盛岩）、礁池、干瀬、礁斜面に区分される（図３）。潮位によって、潮間帯上部、潮間帯下部、潮下帯に分けられる。基盤は岩礁と砂礫底に分類される。そこで、次の４ヶ所の海岸、テクル、オアウからトカテアに至る区間（オアウ・トカテア間、表２ではOT）、アツオコロ水路からクムクム水路に至る区間（アツオコロ・クムクム間、表２ではAK）、カランガヌイ水路周辺（カランガヌイ）（図２）で、現生貝の生息条件（地形、潮位、基盤）を調べた。すなわち、岩棚（盛岩）と礁池と干瀬の間を往復しながら海岸線を進み、見つけた貝の種名を同定し、それらの生息条件を記録した。

表２に、４海岸に現生する貝種とその生息条件（地形、潮位、基盤）を示す。全海岸では合計で２９種の貝が確認された。また、遺跡の人々が確実に利用した９種は、全て遺跡近くの海岸（オアウ・トカテア間）に現生していることが判明した。

図３は、先に述べた９種の貝の生息条件を示す。これら９種の生息条件が過去も現在と同じであったと仮定すれば、遺跡の人々は各々の貝を裾礁の次のような場所で採集したはずである。すなわち、リュウキュウマスオガイとアラヌノメガイは、陸に近い礁池の潮間帯下部の砂礫底で、コオニノツノガイは、陸に近い礁池の潮間帯下部の岩礁で、小型のシラナミガイ、シシガシラザル、ムカシタモトガイは、沖に近い礁池の潮間帯下部の岩礁で、オオウラウズガイは、礁池の潮下帯の岩礁で、リュウキュウヒバリガイは、沖に近い礁池と干瀬の潮間帯下部の岩礁で、マルサザエは、干瀬の潮間帯下部の岩礁で採集したはずである。また大型のシラナミガイは、礁斜面の水深１０から２０メートルの潮下帯の岩礁で採集したはずである。

このように、遺跡の人々は貝を採集するために、礁池の陸に近い部分

から沖に近い部分まで、さらに干瀬から礁斜面にいたるまで、裾礁全体を利用していたと考えられる。

5　貝の大きさへの選択性

人々はどのような大きさの貝を利用していたのだろうか。それを貝種ごとの貝殻重量を目安に調べた。

遺跡から出土した貝殻の多くは破損したり劣化しているため、直接には重量を求められない。そこで、先の４ヶ所の海岸で現生貝を採集して、個々の貝から貝肉を抜き取って貝殻だけの重量を計り、貝種ごとの貝殻１個あたりの平均重量を求めた。

表２に、そうして求めた現生種の貝殻１個あたりの平均重量（表２ではW）を示す。問題となる９種のうち、６種は貝殻重量が比較的大きかった。つまり、現生２９種のなかで、大型のシラナミガイの値は最も大きく、シシガシラザルは２番目、マルサザエは５番目、リュウキュマスオガイ、アラヌノメガイ、小型のシラナミガイ、オオウラウズガイは、６番目から９番目に大きかった。このことから、遺跡の人々は大型の貝種を選択的に利用する傾向にあったということが推論できる。

しかし９種のなかには大型でない種もあった。貝殻重量が最も小さいコオニノツノガイ、２９種中３番目に小さいムカシタモトガイ、１４番目に小さいリュウキュウヒバリガイである。現在のマンガイア島民はこれらの貝をスナックとして嗜好し、また首飾りや衣装飾りとして用いていることから、これらの貝種は味や形などの点から選択されていたと考えられよう。

６　最もよく利用された貝種

ワイロロガ遺跡の人々はどの貝を特によく利用したのだろうか。そこで、人々が利用したと考えられる９種について、貝種ごとの角型の出土重量と出土総重量の推定値を求めた。

まず、角型の出土重量については、最も多かったのがマルサザエであった。以下、コオニノツノガイ、シラナミガイ、オオウラウズガイ、シシガシラザル、ムカシタモトガイ、リュウキュウマスオガイ、リュウキュウヒバリガイ、アラヌノメガイが続いた（表１）。

しかし角型の多くは割れているので、出土重量は利用された貝の個体数を反映していない可能性がある。そこで、利用された貝の個体数を、角型の最小同定個体数（表１ではMNI）、つまり明らかに別個体である角型の出土個体数から推定し（表１）、「角型の最小同定個体数×貝殻１個あたりの平均重量」（出土総重量の推定値）を求めた。この値は、マルサザエで２６７３・８（ｇ）と最も大きく、次いでシラナミガイ（９７８・６ｇ）、シシガシラザル（５９４・１ｇ）、オオウラウズガイ（５４１・５ｇ）、リュウキュウヒバリガイ（２９６・１ｇ）リュウキュウマスオガイ（２８７・２ｇ）、ムカシタモトガイ（２３９・２ｇ）、コオニノツノガイ（１４０・２ｇ）、アラヌノメガイ（９１・２ｇ）の順であった。

このように、角型の出土重量でも出土総重量の推定値でも、利用された貝種の中ではマルサザエの値が最大であった。このことから、遺跡の人々はマルサザエを特別に重用したことが推定できる。

７　マルサザエの重用性

マルサザエは南太平洋の他の島でも重用されたのだろうか。そこで、利用された貝種が詳しく記述されている８遺跡（表３）について、出土重量が最も多い貝種をみてみた。

SU-Lo-１遺跡、トアガ遺跡、ホセア遺跡、ウレイア遺跡、ハナミアイ遺跡の５遺跡では、マルサザエが最も多く出土した。アレタイ遺跡とモツラカウ遺跡では、古層ではシラナミガイが最も多かったが、新しい時代の層ではマルサザエが最も多かった。アレタイ遺跡の古層でもマルサザエは２番目に多く、モツラカウ遺跡の古い各層でもマルサザエは２番目から５番目に多かった。つまり、ポリネシアのどの遺跡においてもマルサザエは多く出土していた。一方、ミクロネシアのファイス島ではシラナミガイが最も多く出土した。

このようにマルサザエは、ワイロロガ遺跡だけでなく、特にポリネシアの多くの遺跡において重用されていたことがわかる。

８　利用されなかった大型貝種

遺跡の人々は、大型の種を選択的に利用したようであるが、貝殻重量が３番目に大きいツノレイシガイ（ *Mancinella tuberosa* Roding）と４番目に大きいヒメヤクシマダカラガイを利用しなかったようである。それには理由があるのだろうか。

どちらの種も、礁池の潮間帯下部の岩礁に生息し、特に見つけにくいということはない。この両種が利用されなかった理由はおそらく以下のように考えることができるだろう。

現在のマンガイア島民は、ヒメヤクシマダカラガイを含むタカラガイ

科の貝を食べない。タカラガイは他の貝に比べて殻口が狭いうえに殻が堅く、貝肉を取り出すことが困難なためである。しかし、首飾りや衣装飾りとしては利用している。遺跡の人々が現在の人々と同様の理由でヒメヤクシマダカラガイを食べなかった可能性は高い。しかし装飾用にもこの貝種は用いられなかったようである。

現在のマンガイア島民はツノレイシガイを食用としている。この貝は、現在テクルとカランガヌイの海岸には生息するが、遺跡に近いオアウ・トカテア間、およびアツオコロ・クムクム間の海岸には生息しない。ツノレイシガイの生息分布が過去も現在と同じであったと仮定すれば、遺跡でツノレイシガイが利用されなかった理由として、人々が、遺跡から北へ約８キロメートル離れたカランガヌイへも、南へ約２・５キロメートル離れたテクルへも貝の採集に行かず、この貝を実際に採らなかったという可能性が考えられる。

なぜ、人々は限られた範囲の海岸で貝の採集を行ったのだろうか。遺跡の人々が、約２・５キロメートル離れたテクル海岸まで日常的に貝を採りに行くことが可能だったことは、今から約３０年前、アツオコロ水路海岸から約３・４キロメートル離れた海岸まで日常的に貝を採りに行っていた、という、ある６０歳代の女性の証言からも明らかである。

沿岸の漁場が分割され、各区域が特定の集団に占有されている例が太平洋の各地でみられる[Beaglehole and Beaglehole 1938:32、近森1988：106、194など]。マンガイア島では、１９世紀頃には土地と裾礁が分割され（図２）、各人が利用できる土地が厳密に定められていた[Buck 1934:113 127-129]。１９世紀のような裾礁の分割がワイロロガ遺跡の時代にもあり、人々が利用できる裾礁の範囲が定められていたならば、遺跡の人々が北へ約８キロメートル離れたカランガヌイ海岸へも南へ約２・

５キロメートル離れたテクル海岸へも貝の採集に出かけなかった、という可能性も考えられる。

四　まとめ

クック諸島マンガイア島のワイロロガ先史生活遺跡から出土した貝殻遺物と、マンガイア島の現生貝を分析し、先史時代の人々の貝利用について考察した。

分析の結果、先史時代のマンガイア島の人々の貝利用について次のようなことが推論できた。ワイロロガ遺跡の人々は、裾礁全体をくまなく利用して巻貝や二枚貝を採集していたようであり、島で手に入る貝資源を無駄なく利用していたことは間違いないであろう。人々は貝を食料や道具などとして用いる際に、大型の貝を選択的に利用し、特にマルサザエをよく利用していたようである。マルサザエは、ポリネシアの多くの島で重用された貝であるが、食用としてだけでなく、貝殻が釣針の材料に適しており、利用効率のよい貝であったのだろう。このように、ワイロロガ遺跡の人々は、島で手に入る貝資源を無駄なく効率的に利用するという形で、限られた資源しか利用できない島嶼環境への適応を成し遂げていたのだと考えられる。

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表１

表題：

　出土した貝殻遺物の分類群ごとの出土重量、種ごとの角型と丸型の個数と角型の割合、角型の重量と最小同定個体数

解説：

　シロイガレイシガイとキマダライガレイシガイは区別がつかなかったので併記した。MNIは角型の最小同定個体数である。

科名 巻貝	種名	和名	マンガイア名	出土重量 (g)	角型 （個）	丸型 （個）	角型 （%）		角型重量 (g)	MNI
Patellidae ツタノハガイ	*Patella flexuosa Quoy et Gaimard*	ツタノハガイ	Mapii	48.5	20	102	16.4			
Acmaeidae ユキノカサガイ	Patelloida sp.		Mama	6.6						
Turbinidae	*Turbo setosus Gmelin*	マルサザエ	Ariri	748.4	180	105	63.2	＊＊	537.5	74
リュウテンサザエ	*Astralium rhodostoma (Lamarck)*	オオウラウズガイ	Karikao	213.4	82	52	61.2	＊＊	206.8	26
Neritidae	*Nerita plicata Linnaeus*	キバアマガイ	I'i	16.6	5	24	17.2			
アマオブネガイ	Neritidae spp.			0.6						
Littorinidae タマキビガイ	*Tectarius coronatus Valenciennes 1832*	イガタマキビ	Avareoronga	5.4	2	8	20.0			
Cerithiidae オニノツノガイ	*Cerithium columna Sowerby*	コオニノツノガイ	Roarora	364.6	352	38	90.3	＊＊	342.2	323
Hipponicidae	*Antisabia foliacea (Quoy et Gaimard)*	カワチドリガイ		34.0	1	158	0.6			
スズメガイ	*Sabia conica acuta (Quoy et Gaimard)*	アツキクスズメ		5.3	3	13	18.8			
	Pilosabia trigona (Gmelin)	スズメガイ		0.1	0	1	0.0			
Strombridae スイショウガイ	*Canarium mutabilis (Swainson)*	ムカシタモトガイ	Popoto Mageogeo Pu	124.8	187	19	90.8	＊＊	119.2	130
Cypraeidae	*Staphylaea nucleus (Linnaeus)*	イボダカラガイ	Poreo	3.2	0	1	0.0			
タカラガイ	*Ravitrona caputserpentis (Linnaeus)*	ハナマルユキダカラガイ	Poreo	39.3	3	13	18.8			
	Mauritia depressa (Gray)	ヒメヤクシマダカラガイ	Poreo	19.6	0	2	0.0			
	Cypraeidae spp.			122.8						
Cymatiidae フジツガイ	Cymatiidae spp.			28.0						
Cymatiidae /Fasciolariidae フジツガイ／ イトマキボラ	Cymatiidae/Fasciolariidae spp.			9.6						
Tonnidae ヤツシロガイ	Tonnidae sp.			3.2						
Murucidae アクキガイ	*Drupa ricinus hadari Emerson et.Cernchorsky* */Drupa ricinus (Linnaeus)*	シロイガレイシガイ ／キマダライガレイシガイ	Mageogeo	152.8	46	110	29.5	＊		
	Drupa rubuscaesium Roding	アカイガレイシガイ	Mageogeo	2.4	0	1	0.0			
	Drupa morum Roding	ムラサキイガレイシガイ	Mageogeo	10.7	1	7	12.5			
	Thais spp.			16.4						
	Morula spp.			13.0						
	Muricidae spp.			69.7						
Coralliophilidae サンゴヤドリガイ	*Quoyula monodonta (Blainville)*	ヒトハサンゴヤドリガイ		1.3	0	1	0.0			
Buccinidae エゾバイ	*Pollia undosus Linnaeus*	スジクロホラダマシ		17.0	6	17	26.1			
Nassariidae ムシロガイ	*Nassarius* spp.			0.3						
Fasciolariiae イトマキボラ	*Peristema nassatula (Lamarck)*	ムラサキツノマタガイモドキ		9.4	2	13	13.3			

科名	種名	和名	マンガイア名	出土重量 (g)	角型 (個)	丸型 (個)	角型 (%)		角型重量 (g)	MNI
Mitridae	Mitridae spp.			2.9						
フデガイ										
Conidae	*Virroconus ebraeus (Linnaeus)*	マダライモガイ	Popoto	4.5	4	2	66.7	*		
イモガイ	*Virroconus chaldeus (Roding)*	コマダライモガイ	Popoto	3.0	4	0	100.0	**		
	Virroconus sponsalis (Hwass)	ハナワイモガイ	Popoto	3.3	0	1	0.0			
	Virroconus fulgetrum (Sowerby)	サヤガタイモガイ	Popoto	5.9	1	2	33.3			
	Chelyconus catus (Hwass)	アラレイモガイ	Popoto	6.6	1	4	20.0			
	Rhizoconus rattus (Hwass)	ハイイロミナシガイ	Popoto	13.4	0	1	0.0			
	Conidae spp.			241.2						
Pyramidellidae	*Otopleura mitralis (A.Adams)*	シイノミクチキレ		1.3	0	1	0.0			
トウガタガイ										
Siphonariidae	*Siphonaria laciniosa Linnaeus*	コウダカカラマツガイ	Mapii	0.7	1	6	14.3			
コウダカカラマツガイ										
二枚貝										
Arcidae	*Arca arabica Philippi*	ネジアサリ		56.1	19	69	21.6			
フネガイ										
Mytilidae	*Modiolus auriculatus (Krauss)*	リュウキュウヒバリガイ	Kakuku	116.0	104	23	81.9	**	88.9	63
イガイ										
Pteriidae	*Pinctada* sp.		Parau	50.2						
ウグイスガイ										
Pectinidae	*Gloripallium pallium (Linnaeus)*	チサラガイ		0.4	0	1	0.0			
イタヤガイ										
Spondylidae	*Spondylus* spp.			1.9						
ウミギクガイ										
Limidae	*Lima* sp.			6.3						
ミノガイ										
Lucinidae	*Epicodakia bella (Conrad)*	ヒメツキガイ	Tunani	18.8	12	27	30.8			
ツキガイ			Ka'i							
Chamidae	*Chama plinthota Cox*	シシガシラザル	Pauakute	155.8	33	16	67.3	**	143.0	7
キクザルガイ	*Chama* semipuopurata	ソメワケガシラ		57.1	11.00	83	13.3			
Cardiidae	*Corculum impressum (Solander)*			0.0						
ザルガイ										
Tridacnidae	*Tridacna maxima (Roding)*	シラナミガイ	Paua	317.8	12	11	52.2	**	大237.55	1
シャコガイ									小14.45	6
Veneridae	*Periglypta reticulata (Linnaeus)*	アラヌノメガイ	Ka'i	33.9	5	3	62.5	*	27.6	3
マルスダレガイ			Tunani							
Psammobiidae	*Asaphis dichotoma (Anton)*	リュウキュウマスオガイ	Ka'i	102.1	26	8	76.5	**	91.6	8
シオサザナミガイ										
Tellinidae	*Scutarcopagia scobinata (Linnaeus)*	サメザラガイ	Tunani	2.5	3	5	37.5			
ニッコウガイ			Ka'i							
巻貝合計				2369.8						
二枚貝合計				918.8						
不明				75.6						

＊＊:$p<0.01$, ＊:$p<0.1$

表２

表題：マンガイア島の海岸に現生する貝種、その生息条件、貝殻１個あたりの平均重量

解説：

〇は現生している、×現生していない、△は現生している情報が得られた場合。＊は遺跡から出土した貝種。貝の生息条件は種で一定しており、どの海岸でも一致していた。OTはオアウ・トカテア間、AKはアツオコロ・クムクム間、Wは貝殻１個あたりの平均重量である。

和名	テクル	OT	AK	カランガヌイ	地形	潮位	基盤	W	標準偏差	最小	最大	個体数
イガタマキビ＊	○	○	○	○	岩棚 盛岩	潮間帯上部	岩礁	3.5	1.4	0.8	6.8	33
キバアマガイ＊	○	○	○	○	岩棚 盛岩	潮間帯上部	岩礁	2.5	1.0	0.9	4.6	24
ニシキアマオブネガイ	×	×	○	×	礁池	潮間帯下部	岩礁	7.4	1.9	5.3	9.2	4
	×	×	○	×	礁池	潮間帯下部	砂礫底					
リュウキュウマスオガイ＊	×	○	○	×	礁池	潮間帯下部	砂礫底	35.9	33.7	5.0	118.6	12
アラヌノメガイ＊	×	○	×	×	礁池	潮間帯下部	砂礫底	30.4	14.2	13.4	43.0	4
コオニノツノガイ＊	×	○	×	×	礁池	潮間帯下部	岩礁	0.4	0.2	0.2	0.8	28
シシガシラザル＊	○	○	○	○	礁池	潮間帯下部	岩礁	84.9	15.8	70.4	112.9	6
マダライモガイ＊	○	○	○	○	礁池	潮間帯下部	岩礁	5.0	1.4	2.7	6.1	5
コマダライモガイ＊	○	○	○	○	礁池	潮間帯下部	岩礁	2.7	1.1	1.2	4.7	8
ハナワイモガイ＊	○	○	○	○	礁池	潮間帯下部	岩礁	1.4		1.4	1.4	1
サヤガタイモガイ＊	○	○	○	○	礁池	潮間帯下部	岩礁	3.0		3.0	3.0	1
アラレイモガイ＊	○	○	○	○	礁池	潮間帯下部	岩礁	5.7		5.7	5.7	1
ハイイロミナシガイ＊	○	○	○	○	礁池	潮間帯下部	岩礁	2.2		2.2	2.2	1
ツノレイシガイ	○	×	×	○	礁池	潮間帯下部	岩礁	54.8		54.8	54.8	1
キマダライガレイシガイ＊	○	○	○	○	礁池	潮間帯下部	岩礁	3.5		3.5	3.5	1
シロイガレイシガイ＊	○	○	○	○	礁池	潮間帯下部	岩礁	3.6	0.9	1.1	7.2	52
アカイガレイシガイ＊	×	○	×	×	礁池	潮間帯下部	岩礁	18.0		18.0	18.0	1
ムラサキイガレイシガイ＊	○	○	○	○	礁池	潮間帯下部	岩礁	13.7	4.9	7.2	22.0	9
コイボテツレイシ	○	○	○	○	礁池	潮間帯下部	岩礁	11.9	4.1	7.0	19.5	6
キイロダカラガイ	○	○	○	○	礁池	潮間帯下部	岩礁	2.4		2.4	2.4	1
フシダカキイロダカラガイ	○	○	○	×	礁池	潮間帯下部	岩礁	2.6	0.4	2.1	3.1	5
ハナマルユキダカラガイ＊	○	○	○	○	礁池	潮間帯下部	岩礁	6.3	1.8	4.5	7.9	4
ヒメヤクシマダカラガイ＊	○	○	○	○	礁池	潮間帯下部	岩礁	49.3	11.9	36.2	59.4	3
リュウキュウヒバリガイ＊	×	○	×	×	礁池	潮間帯下部	岩礁	4.7	2.3	1.9	8.3	6
	×	○	×	×	干瀬	潮間帯下部	岩礁					
ツタノハガイ＊	○	○	○	○	礁池	潮間帯下部	岩礁	3.4	2.5	1.0	9.1	19
シラナミガイ（小）＊	○	○	○	○	礁池	潮間帯下部	岩礁	29.8	13.4	12.5	79.8	59
シラナミガイ（大）＊	△	△	×	×	礁斜面	潮下帯	岩礁	800		800	800	1
ムカシタモトガイ＊	×	○	×	×	礁池	潮間帯下部	岩礁	1.8		1.8	1.8	1
オオウラウズガイ＊	○	○	○	○	礁池	潮下帯	岩礁	20.8	5.1	10.3	30.9	29
マルサザエ＊	○	○	○	○	干瀬	潮間帯下部	岩礁	36.1	23.2	4.9	73.5	12

表３

表題：最も出土重量が多かった貝種についての太平洋の８遺跡の比較

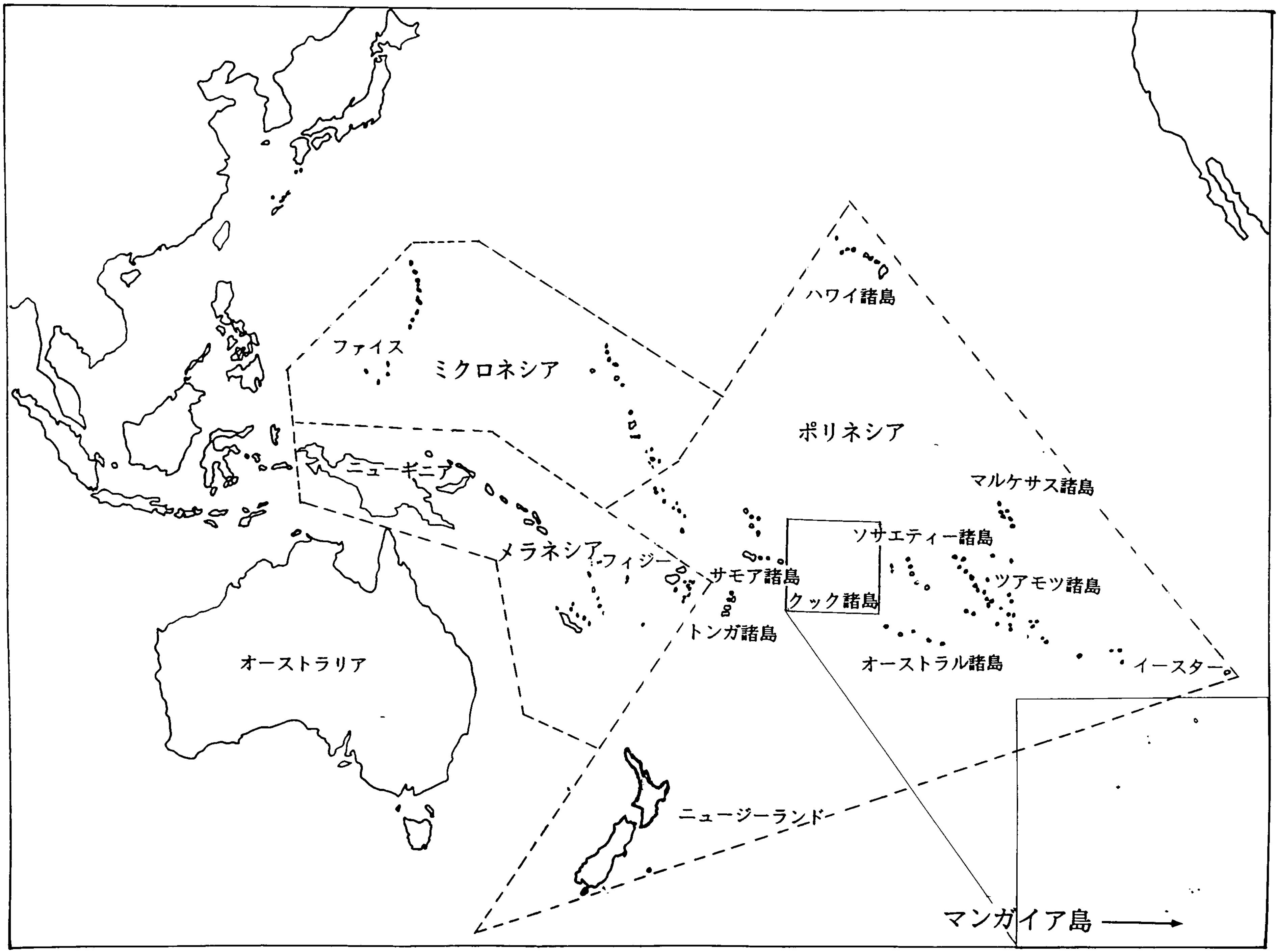
解説：

　出土した貝殻遺物について角型と丸型の区別を行い、角型の出土重量が記載されている文献に限った。

遺跡	1・SU-Lo-1	2・トアガ	3・アレタイ	4・ホセア	5・ウレイア	6・モツラカウ	7・ハナミアイ	8・ファイス
地域	ポリネシア	ポリネシア	ポリネシア	ポリネシア	ポリネシア	ポリネシア	ポリネシア	ミクロネシア
諸島名	サモア諸島	サモア諸島	クック諸島	クック諸島	クック諸島	クック諸島	マルケサス諸島	
島名	ウポル島	オフ島	アイツタキ島（本島）	アイツタキ島（本島）	アイツタキ島（本島）	アイツタキ島（離島）	タフアタ島	ファイス島
島の形態	火山島	火山島	火山島	火山島	火山島	礁湖の小島	火山島	隆起珊瑚礁島
遺跡の種類	生活址	生活址	生活址	生活址	生活址	漁労活動のキャンプ	生活址	生活址
遺跡の位置	海岸	海岸	海岸	海岸	海岸	海岸	海岸	海岸
遺跡の年代	B.P.800～600	B.P.4400～1100	A.D.15～17世紀 A.D.16～17世紀	A.D.13～17世紀	A.D.9～20世紀	A.D.11～15世紀 A.D.14～20世紀	A.D.11～15世紀	A.D.1～13世紀
最も多く出土した貝	マルサザエ	マルサザエ	シラナミガイ マルサザエ	マルサザエ	マルサザエ	シラナミガイ マルサザエ	マルサザエ	シラナミガイ
出典	Davidson[1969]	Kirch and Hunt[1993]	Allen [1992]	Allen[1992]	Allen[1992]	Allen [1992]	Rollett[1989]	Intho[1993] Igarashi[nd]

図１

表題：太平洋およびクック諸島



ハワイ諸島
ファイス
ミクロネシア
ポリネシア
ニューギニア
マルケサス諸島
ソサエティー諸島
メラネシア
フィジー
サモア諸島
ツアモツ諸島
クック諸島
トンガ諸島
オーストラリア
オーストラル諸島
イースター
ニュージーランド
マンガイア島

図２

表題：　マンガイア島

解説：黒塗りの範囲の裾礁で貝の生息条件を調査した。

点線は、１９世紀の地区（プナ）の境界線[Buck 1934: Figure1]を示す。各プナはさらに裾礁と土地がセットになった占有的な小地区（タペレ）に分けられていた。

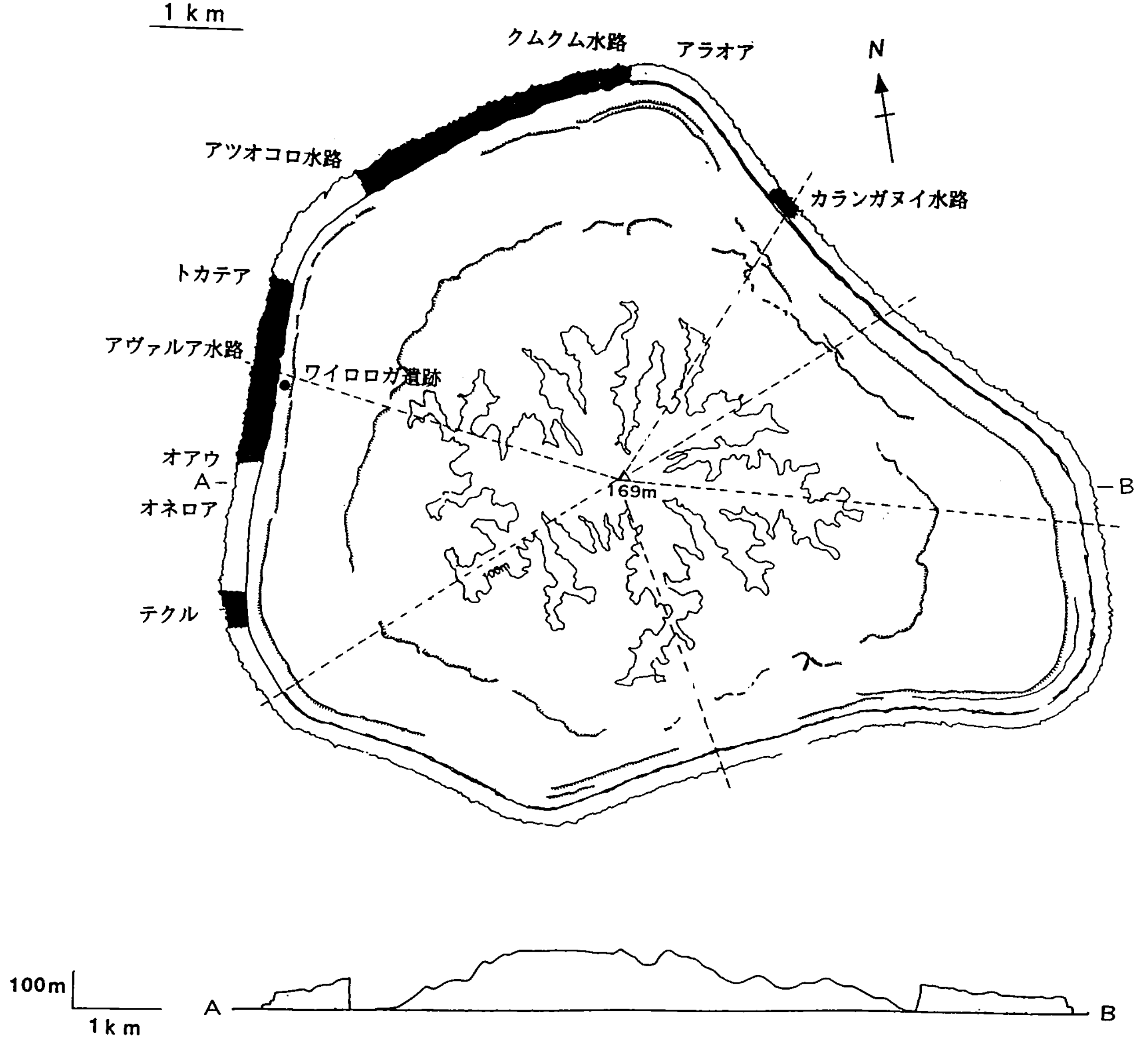

1 km
クムクム水路
アラオア
N
アツオコロ水路
カランガヌイ水路
トカテア
アヴァルア水路
ワイロロガ遺跡
オアウ
A
169m
B
オネロア
100m
テクル
100m
A
1 km
B

図 3

表題：マンガイア島の裾礁での現生貝種の生息条件。

解説：盛岩とは、岸の所々に見られる岩盤の小さな盛り上がりである。

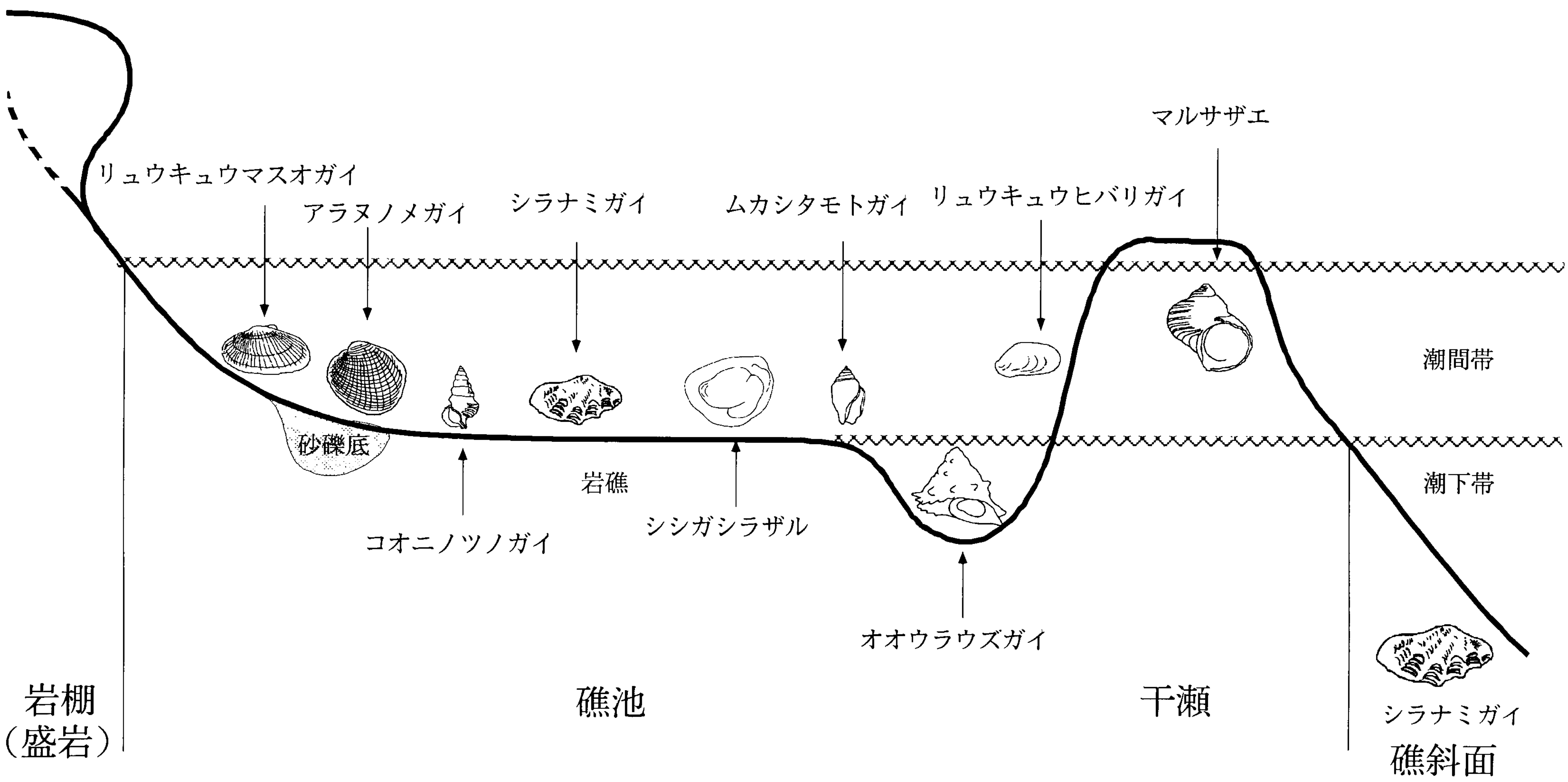

リュウキュウマスオガイ
アラヌノメガイ
シラナミガイ
ムカシタモトガイ
リュウキュウヒバリガイ
マルサザエ
潮間帯
潮下帯
砂礫底
岩礁
コオニノツノガイ
シシガシラザル
オオウラウズガイ
シラナミガイ
岩棚
（盛岩）
礁池
干瀬
礁斜面

写真１

表題：礁池での魚釣り

解説：満ち潮の時に岸から釣り糸を垂れる。このときの収穫はベラ、ニザダイ、アイゴ、ウツボであった。

写真２

表題：礁池での貝の採集

解説：潮の引いた礁池で足首まで水に浸かりながら貝の採集をする人々。道具は、ナイフ、スプーン、ポリバケツ。時には茹でたタロイモを携えて行き、とれたての貝と一緒に食べる。

写真３

表題：マルサザエ

解説：左端が現生貝、中央２列が遺跡から出土した角型、右端が遺跡から出土した丸型である。